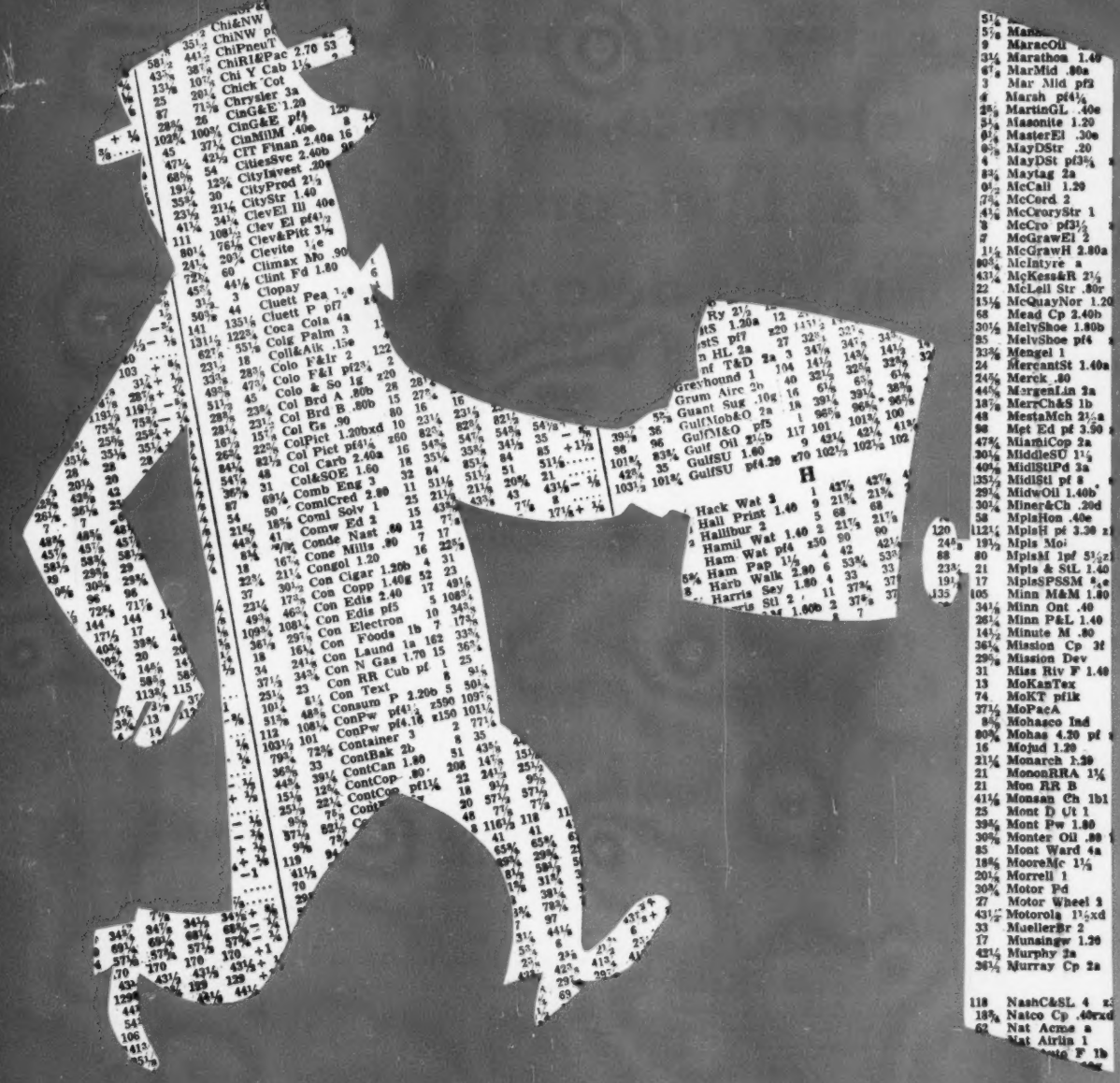
The Electrical Industry's Weekly Magazine

April 16, 1956

Electrical World

Price 35 Cents

A McGraw-Hill Publication



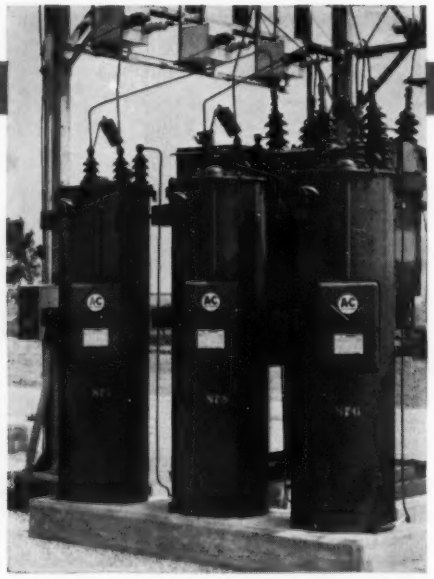
HOW A UTILITY RAISES FUNDS

A Special Report . . . . . Page 101

One operator writes this about Allis-Chalmers field help:

"When A-C people work on a regulator, they show up *with* the parts they might need, open the regulator once, service it, and it goes back on the line without delay."

ALLIS-CHALMERS
Originators of
5/8% Step
Voltage Regulators



FOR EITHER substation or feeder regulation, A-C distribution regulators meet system needs.

There's plenty of reason for praise like this. Allis-Chalmers voltage regulators are designed for fast, convenient servicing. A-C engineers understand the need for continuous operation and provide for it in their regulator's design.

Allis-Chalmers field service helps you get the most profit from your regulator operation. Field stocks of needed parts are available for fastest possible delivery. Factory service includes help in getting parts to you fast, plus engineering assistance whenever and wherever you need it.

Find out for yourself. Ask about Allis-Chalmers regulator service. Call the A-C office nearest you or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

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ALLIS-CHALMERS

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Electrical World

Published for 82 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

VOL. 145 No. 16 **April 16, 1956**

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Mr. C. J. Cox (at right, above) supervises the installation of Okonite Splicing Tape on 2300 volt motor lead in Seabrook Farms food freezing plant. For 29 years Mr. Cox has standardized on Okonite splicing materials to assure water-tight seals on cables throughout the plant. Note moisture conditions indicated by frozen condensation on pump head.

Okonite Tapes resist moisture, freezing...

keep world's largest food freezing plant operating

For 29 years, Mr. C. J. Cox, supervisor of all construction and engineering for Seabrook Farms Co., has depended on Okonite Tapes to maintain the vast electrical network that keeps the world's largest food freezing plant operating. All electrical circuits (totaling 20,000 h.p. connected load), lights, as well as power for the motors and pumps which provide continuous freezing and storage capacity, are spliced and terminated with waterproof Okonite Tapes to assure positive protection against the moisture always present in the plant.

In every phase of Seabrook's operation, moisture is a problem. Treatment of food, freezing, processing, storing . . . all are damp operations with continuous condensation on cables and equipment alike. Low temperatures of the freezing and holding rooms make splicing difficult.

Okonite Tapes offer effective waterproof splices that are not affected by dampness or low temperatures. Both Okonite Rubber Tape and Okolite High Voltage Tape fuse into a solid self-vulcanizing wall of tough, waterproof insulation. Protected by Manson Friction Tape, splices maintain their moisture resistance through many years of exposure to condensation and freezing temperatures.

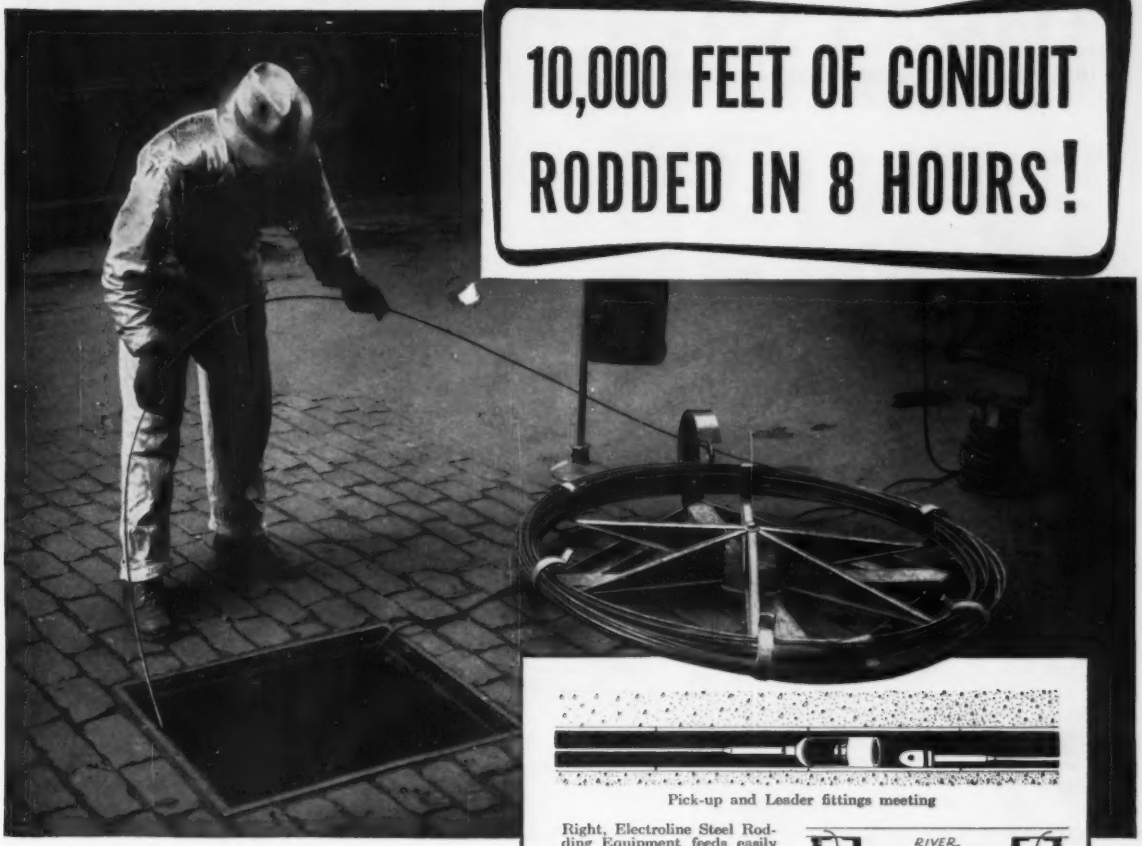
Try them on your own splices—write for this free box of 4 sample tapes to The Okonite Company, EW Tape Department, Passaic, N. J.

Available Through Authorized Distributors Only

OKONITE **splicing materials**

3521

10,000 FEET OF CONDUIT RODDED IN 8 HOURS!



Pick-up and Leader fittings meeting

Right, Electroline Steel Rodding Equipment feeds easily around the bends.

Below, Leader locked in Pick-up for either push or pull.

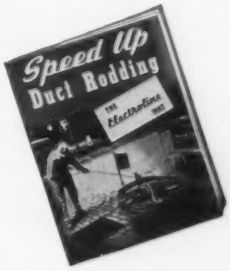
EASY DOES IT!—It's all in a day's work with Electroline Steel Duct-Rodding Equipment rodding 10,000 feet of conduit!

Light in weight, easily handled and stored, low upkeep: these are a few of the advantages utility men know to be true. But even bigger, more important advantages are—

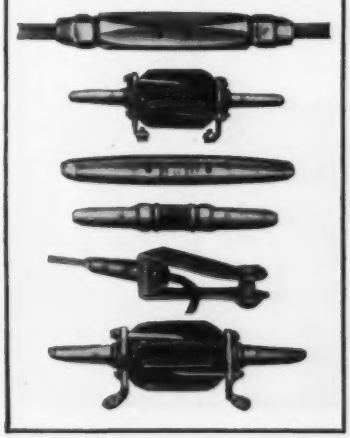
- *Savings in the cost of labor*—for example, where it formerly took two gangs from one to two weeks on a given job, one gang, *in one-half hour*, has completed the same job—using Electroline Duct-Rodding Equipment.
- *Savings in original cost*—you get long life—double that of other types—when you buy Electroline Duct-Rodding Equipment. Add to that this fact: this equipment costs just about half as much for equivalent capacity! *There's true economy.*
- *Savings in Total Investment*—fewer sets are required because of the speed with which a job is completed and the equipment moved to other locations.

Speed up installation, reduce your costs; start now to use Electroline Duct-Rodding Equipment. Available for 3", 3½" or 4" Duct.

We've got a 4-page brochure which describes and illustrates more completely how this equipment can benefit you. We'll gladly send you a copy. Write us.



OTHER *Electroline* PRODUCTS

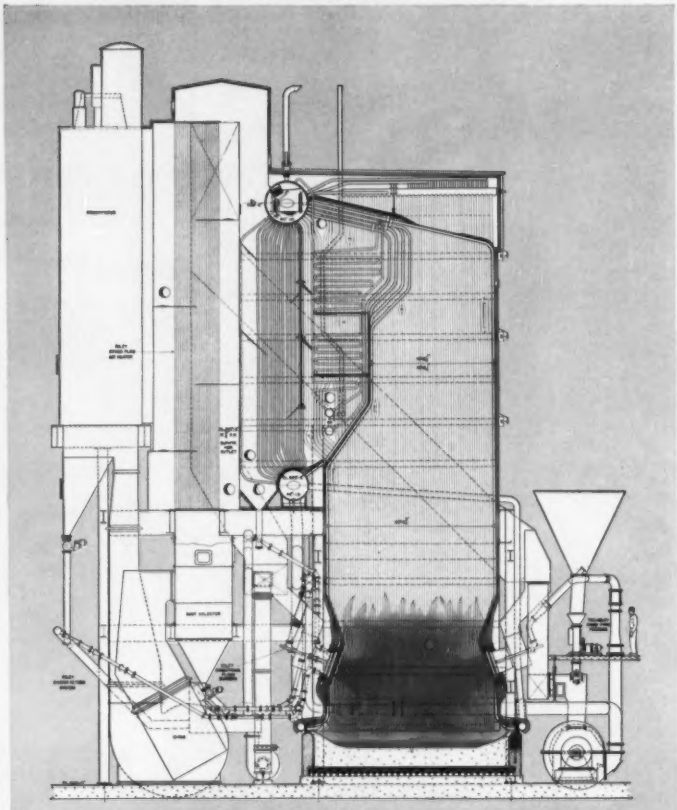


Electroline Company

4121 South La Salle St., Chicago 9, Ill.
In Canada: POWERLITE DEVICES, LTD., TORONTO

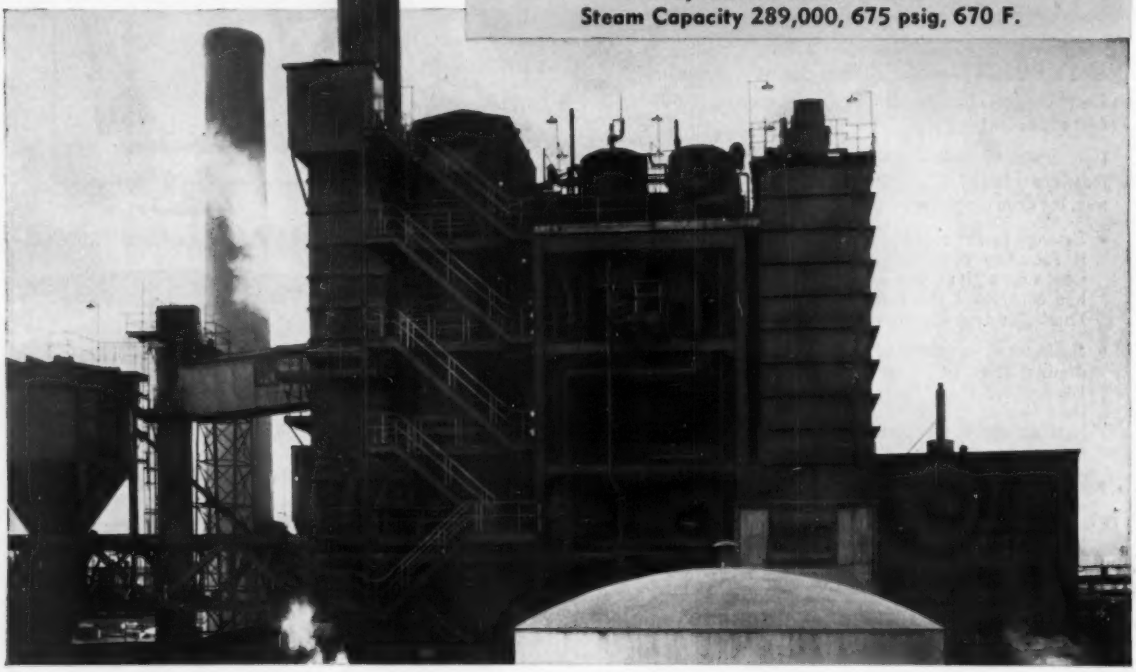
A 1955 POWER MODERNIZATION AWARD WINNER

This 289,000 lb./hr. Riley TURBO FURNACE Unit replaces several low capacity, low efficiency units and is part of a modernization program that has resulted in a total of $470,000 annual savings on the making of steam by the original boilers. A considerable part of this saving is due to the TURBO FURNACE Unit's high efficiency, low carbon loss in fuel, lower maintenance, elimination of flyash disposal problem.



Riley TURBO FURNACE unit
Steam Capacity 289,000, 675 psig, 670 F.

One of two TURBO FURNACE Units and one of a total of 26 Riley Units purchased by this chemical company . . . a total steam generating capacity of *five and one half million pounds per hour!*



A survey of your plant by a consulting engineer could show you ways of making surprising savings in your power costs.

TURNS FLYASH INTO PROFITS

for prominent West Virginia Chemical Company

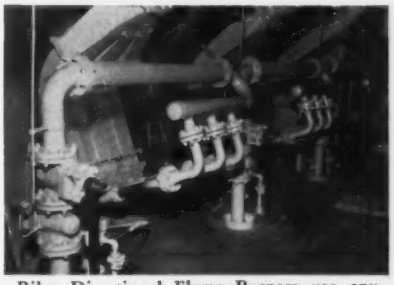
The *New* RILEY

TURBO FURNACE

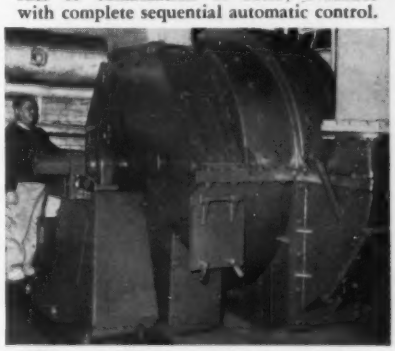
Once flyash disposal was a major problem for this company. Today Riley TURBO FURNACE Units are helping to solve this problem. At Plant (A) flyash is reinjected into the TURBO FURNACE combustion zone where high heat concentration and extreme turbulence converts ash to slag; when tapped and cooled, slag is easily disposed of, resulting in a usable product and a substantial savings in net cost of plant operation. At Plant (B) another Riley TURBO FURNACE unit successfully burns its own flyash . . . and even flyash from an adjacent dry bottom unit.

. . . in addition to eliminating flyash disposal, the Riley TURBO FURNACE also offers users these advantages:

- **Will burn efficiently a wide range of coals, oil, gas, lignite, delayed coke, and fluid coke.**
- **Low carbon loss increases unit efficiencies, lowers fuel cost.**
- **Clean heating surfaces do away with slag blowers.**
- **No stratification of furnace gases.**
- **Furnace exit gas temperatures are the same regardless of fuel.**
- **No change in pressure parts needed when converting to solid fuels.**
- **One level burner operation.**
- **Higher heat release rates: lower overall height.**



Riley Directional Flame Burners use any fuel or combination of fuels; available with complete sequential automatic control.



Riley 550 Pulverizers with Tungsten Carbide faced grinding elements resist wear and reduce maintenance.

UNITS WITH RILEY TURBO FURNACES ARE DESIGNED FOR ANY CAPACITY, PRESSURE, TEMPERATURE

TURBO FURNACE Units have been purchased by *Delaware Power & Light Co.* — three 500,000 lbs./hr. units designed for firing fluid coke; *Texas Electrice Service Co.* — 825,000 lbs./hr. reheat unit designed for firing gas, oil and Texas lignite; *Louisiana Power & Light Co.* — one 1,550,000 lbs./hr. reheat unit designed for firing gas, oil, coal and fluid coke; *Kaiser Aluminum & Chemical Corp.* — two 320,000 lbs./hr. units for gas and oil, future coal.

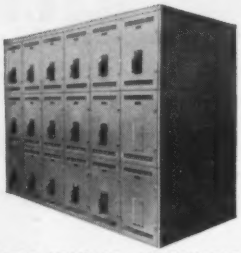
Consult your Riley Representative in these cities for complete details about the Riley TURBO FURNACE.

Worcester, New York, Philadelphia, Buffalo, Washington, Pittsburgh, Cleveland, Detroit, Chicago, Cincinnati, Charlotte, New Orleans, Atlanta, St. Louis, Kansas City, St. Paul, Houston, Denver, Salt Lake City, Los Angeles, San Francisco, Portland, Seattle.

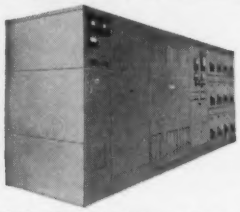
RILEY

Stoker Corporation

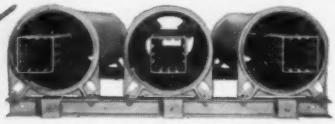
WORCESTER, MASSACHUSETTS



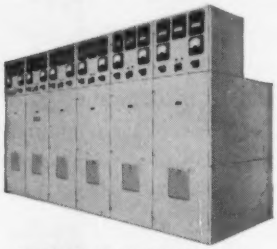
LOW VOLTAGE SWITCHGEAR through 600 v a-c, 250 v d-c, 15,000 through 150,000 amp interrupting, 6000 amp continuous.



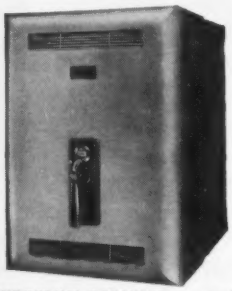
UNIT SUBSTATIONS—primary and secondary, indoor and outdoor construction—in all standard ratings, dry, askarel or oil transformers.



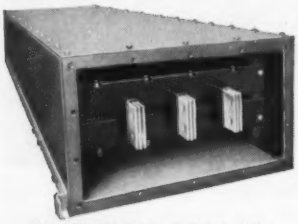
ISOLATED PHASE BUS through 138 kv and 10,000 amp.



METAL-CLAD SWITCHGEAR in ratings from 2400 v through 15 kv, 50 through 500 mva interrupting and 2000 amp continuous.



INDIVIDUAL BREAKERS, a-c and d-c, 15,000 through 150,000 amp interrupting, 6000 amp continuous.



NONSEGREGATED PHASE BUS through 15 kv and 6000 amp.

Economical: an I-T-E Power Package

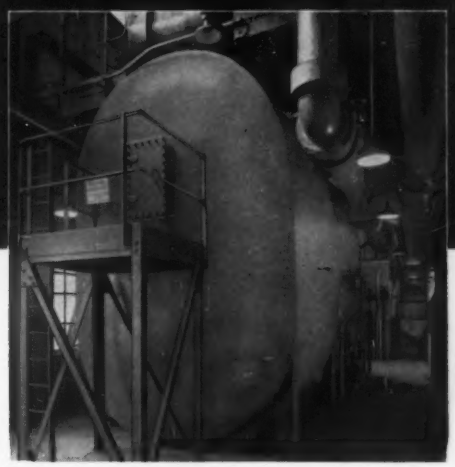
An I-T-E Power Package includes the complete power handling facilities for a new construction project, building addition, or expansion of electrical service—one unit or a complete system for every application from generation to end use. You save in sound planning, easier installation, coordinated delivery, and assured performance—a better investment in every way.

For more information, contact the I-T-E sales office nearest you or write I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY
Switchgear Division

problems in water-conditioning . . .

COMPLETE DEAERATION



COCHRANE DEAERATOR IN A LARGE UTILITY

This giant Cochrane Deaerator, installed in one of the country's largest utilities, has been meeting guarantees for ten years. Special elliptical design was dictated by space limitations. With a capacity of 1,900,000 lbs. per hour, condensate is deaerated to zero (0.005 cc per liter or less) before being fed to high pressure boilers.

Cochrane
Deaerating Efficiency
produces "ZERO OXYGEN!"

The guaranteed completeness and dependability of Cochrane physical deaeration is unsurpassed!

Cochrane pioneered in this field and today has the largest number of deaerator installations in the world. Cochrane's background in deaeration is your assurance that *guarantees will be met!*

Cochrane Corporation designs and manufactures complete lines of deaeration, precipitation, ion exchange and water conditioning equipment. This *complete* service provides single responsibility for engineering, fabrication and continued satisfaction. Consult Cochrane first . . .

For further information on Cochrane Deaerators, write for literature.

COCHRANE CORPORATION · WATER ENGINEERS SINCE 1863 · PHILADELPHIA

Cochrane
CORPORATION

Representatives in 30 principal cities in U.S.; Toronto, Canada; Paris, France; La Spezia, Italy; Mexico City, Mexico; Havana, Cuba; Caracas, Venezuela; San Juan, Puerto Rico; Honolulu, Hawaii.
Pottstown Metal Products Division—Custom built carbon steel and alloy products

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Demineralizers • Hot Process Softeners • Hot Zeolite Softeners • Dealkalizers • Reactors • Deaerators • Continuous Blowoff Systems • Condensate Return Systems • Specialties

OPTIMUM INVESTMENT*
Power Transformers

*Optimum Investment

General Electric's assurance of lower long-term cost, plus greater dividends from your power transformer investment, through:

- **LOW ENGINEERING COST:** G-E field services reduce your engineering expense.
- **LOW PURCHASE COST:** Skill to produce optimum design for each application.
- **LOW INSTALLATION COST:** Upright shipment, one-piece tank speeds handling.
- **LOW OPERATING COST:** Constant characteristics for lasting economy.
- **LOW MAINTENANCE COST:** Product improvements and few failures reduce outages.

VAPOR-PHASE DRYING drives moisture from core-and-coil assembly before tanking. Hot oil vapor in high vacuum dries organic parts, preventing later oil contamination in service. Tightness maintains short-circuit strength.

LOCKING METHODS are special—only four are used. None depend on a cutting or shaving action that chips off metallic shavings. Insulation strength is not impaired by razor-sharp particles. Locking strip, shown above, is one method used.

How much are you paying for aging power transformer characteristics?

General Electric uses the special care necessary to help prevent losses and other characteristics from changing

Power transformers could age. Lightning and surge voltages, system fault currents, years of operating at varying temperatures, pick at the insides of a transformer. Parts could shrink. Braces and clamps could loosen. Then turn-to-turn, layer-to-layer, even lamination shifting (the latter causing interlaminar insulation wearing) could occur. Not readily apparent, this deterioration could reduce impulse and short-circuit strengths, increase core loss, exciting current, noise. Once started, the degeneration tends to be cumulative.

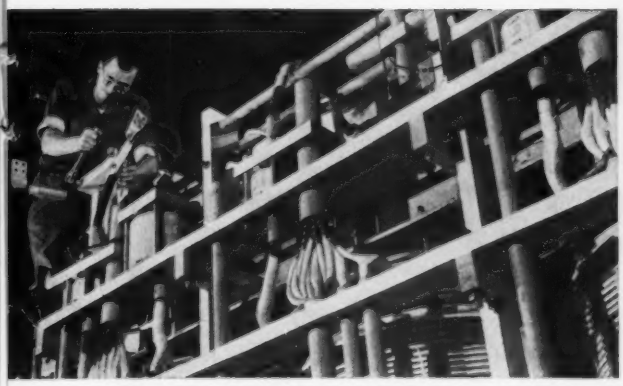
The result of deterioration is higher costs from increased losses and lowered failure resistance. Hence, care must be taken, extra care, to resist costly deterioration. General Electric power transformers have been redesigned, are built with special care to help keep characteristics at their original optimum values. Four examples of this care are: vapor phase drying, the patented process for removing moisture; the stress-resistant braces and clamps; the highly-compressed spacers; and the meticulous attention to locking of studs and bolts.

These are examples of features designed to give you economical operation. There are more. And, combined with other features that give low purchase, installation, maintenance, and engineering costs, they make your General Electric Power Transformer an *Optimum Investment*. General Electric, Schenectady 5, N.Y.

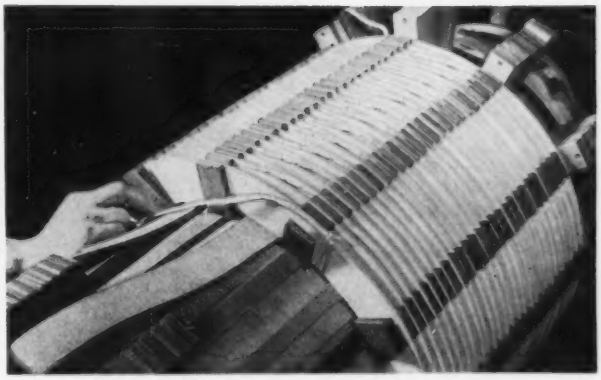
421-43

Progress Is Our Most Important Product

GENERAL ELECTRIC



ASSEMBLY BRACING gives positive pressure for spring-like rigidity. Stress-free clamping holds down core loss, retards abrasive rubbing of laminations. Full strength and low losses are maintained by clamping system.



KEYED WINDING SPACERS, of extra-dense pressboard, are pre-compressed at 24,000 p.s.i. After vapor-phase process removes moisture, adjustable clamps re-compress coil stacks. Spacers don't shrink, loosen, or slip out in service. Coils remain rigid and strong.

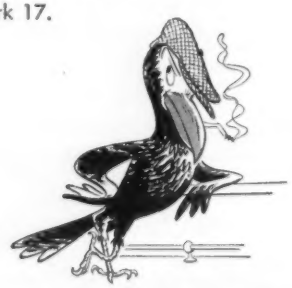
For top value . . . in any type . . . get JENKINS

Gold Seal Tape

FRICTION · RUBBER · PLASTIC

"Tape-saver" size, we call these 20 ft. rolls you get in the 10-roll container of Gold Seal Plastic Tape. It's enough for the average job . . . less tape gets "lost". Workers like the small size. It "swings" easily in tight places.

You get every advantage of Plastic Tape with the plus of proved Gold Seal quality. Try it . . . sample free. Jenkins Bros., Rubber Division, 100 Park Ave., New York 17.



STICKS ON—
STAYS ON

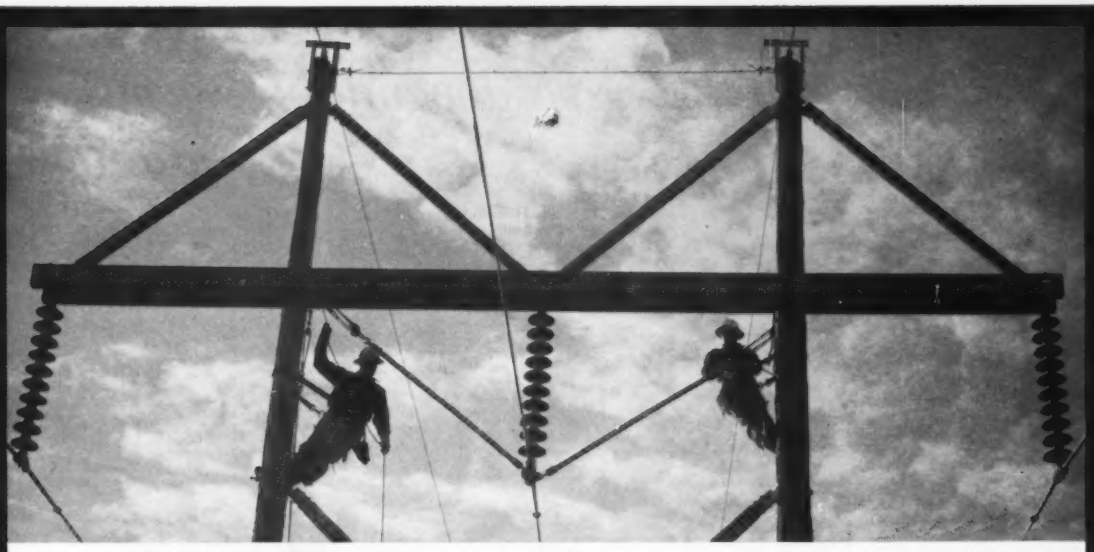
TOUGH PLASTIC DEFIES
WATER, OIL, SOLVENTS,
SUNLIGHT, AND WEATHER

ELASTIC—
MOLDS TO SHAPE

NEAT, THIN
WRAPPING
FULLY INSULATES

TRADE JENKINS MARK
Jenkins Bros

Gold Seal Plastic Tape — Handy Pack of ten 20 ft. rolls and single 60 ft. rolls in round metal cans.



IOWA ELECTRIC LIGHT AND POWER SAYS:

"First Penta-treated poles set in '41...still no sign of deterioration!"

"This company started using Penta-treated poles in 1941. After 15 years, there is no sign of deterioration in any of these poles. I would say that our experience with Penta-treatment has been most satisfactory. We specify full-length Penta-treatment on all transmission line poles."

Allen Hird, Transmission and Distribution Engineer

WHY I&E SPECIFIES PENTA-TREATMENT ON ALL TRANSMISSION LINE POLES

1. MEASURABLE PROTECTION. Increment borings of wood can be chemically analyzed to determine the *exact* amount of Penta present. Heat, rain, frost or snow can't bleed or leach Penta out of wood. Penta offers lasting protection against decay and insects.

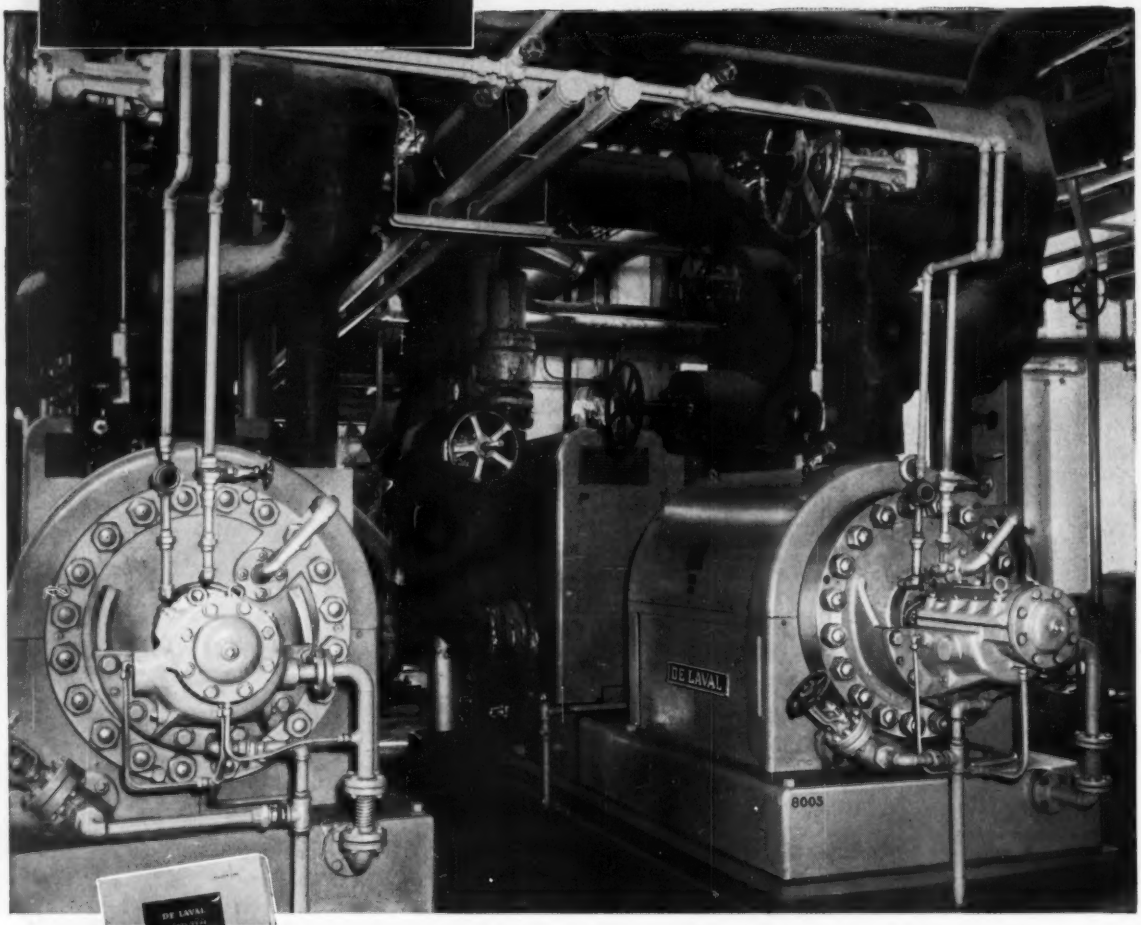
2. CLEANER TO HANDLE, MAINTAIN. Poles treated with Monsanto Penta are cleaner than poles treated with other preservatives. Penta stays locked in wood, can't bleed or leach out. And Penta-treated wood won't "burn" hands, stain clothes.

Monsanto Penta protects poles, crossarms, transformer platforms, braces, control boxes, planking. For list of treating plants serving America's utilities... and FREE Penta "Poles and Crossarms" booklet, write: Organic Chemicals Division, MONSANTO CHEMICAL COMPANY, Dept. PI-2, St. Louis 1, Missouri.

MONSANTO ®

DE LAVAL
BARREL TYPE BOILER FEED PUMPS

give dependable service at Gaylord Container



Bulletin contains helpful data

Bulletin 1506 on the De Laval barrel type boiler feed pump covers all major design points... has cross-section cutaway illustration for easy reference. Write for your copy.

Here's additional proof of De Laval reliability on the line in the Bogalusa, La. plant of the Gaylord Container Corporation. These two De Laval barrel type boiler feed pumps are both driven by De Laval MCP turbines operating at 850 psi, with steam temperature at 825 F.

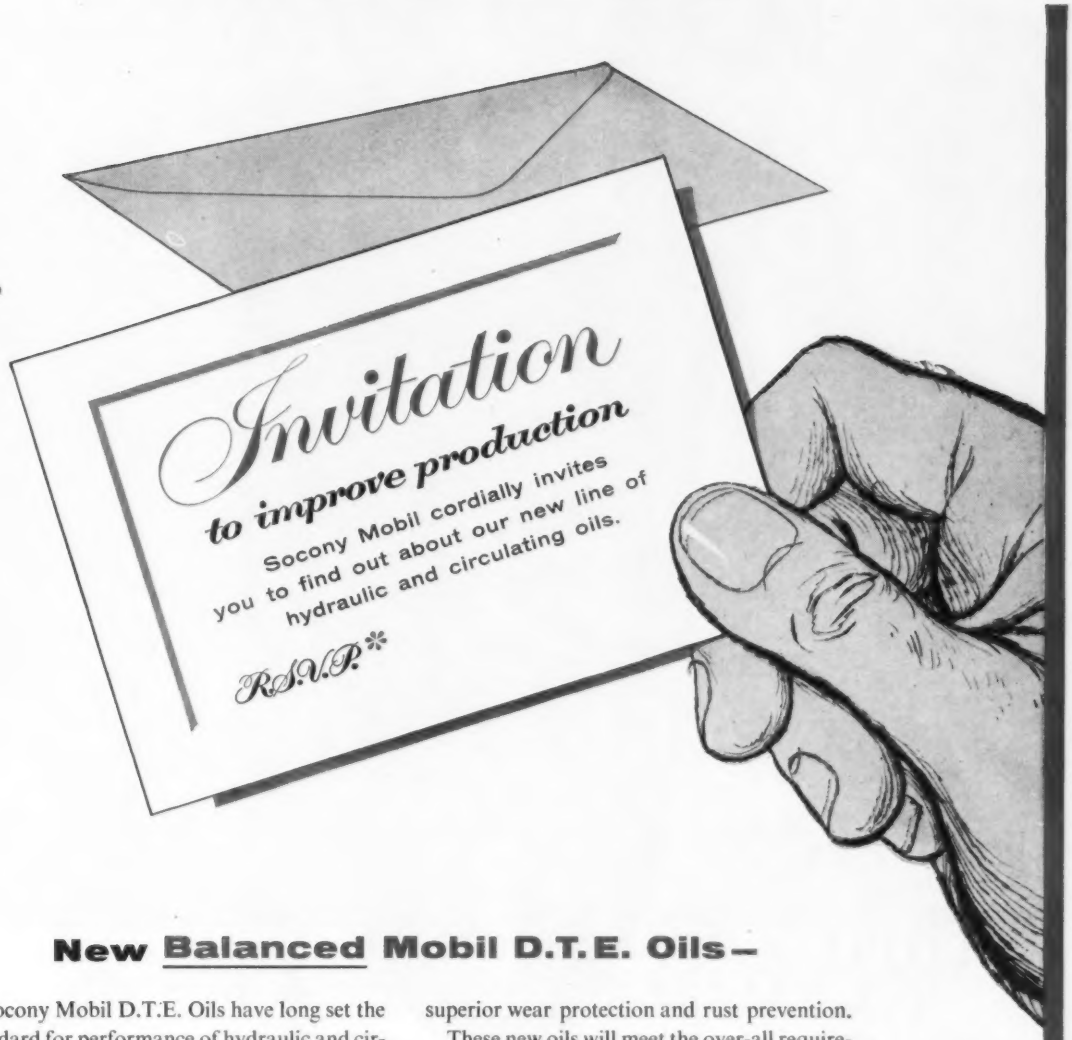
• De Laval barrel type boiler feed pumps are widely used by industrial plants and public utilities. They operate at pressures up to 5,500 psi. These units offer many important design advantages, such as double volute diaphragm, individual diaphragm bolting, positive sealing between suction and discharge chamber and bare shaft construction. Their dependability is proven by year-in, year-out service.

DE LAVAL *Boiler Feed Pumps*

DE LAVAL STEAM TURBINE COMPANY

861 Nottingham Way, Trenton 2, New Jersey

DL 600



New Balanced Mobil D.T.E. Oils—

Socony Mobil D.T.E. Oils have long set the standard for performance of hydraulic and circulating oils. Today, after many years of continuing laboratory research and several years of exhaustive field tests, we announce a completely new line of Mobil D.T.E. Oils. These are balanced to give much greater resistance to deposits, longer life even at high temperatures, superior wear protection and rust prevention.

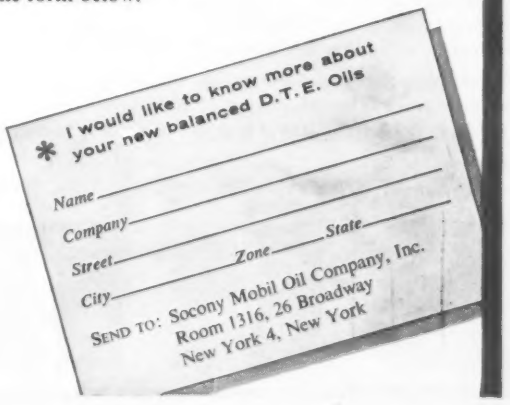
These new oils will meet the over-all requirements of your hydraulic and circulating systems *better than any other product.*

★ ★ ★

For further information on how new D.T.E. Oils can improve your production and cut costs, fill out the form below.

SOCONY MOBIL
CORRECT LUBRICATION
First Step in Cutting Costs

SOCONY MOBIL OIL COMPANY, INC., and Affiliates:
MAGNOLIA PETROLEUM COMPANY, GENERAL PETROLEUM CORPORATION



MD-4 HYTOOL

no. 4 tap thru 2/0 splice

Now, you can install a wide range of distribution connectors on all conductors up to 2/0 . . . with just a single tool. The new MD-4, with interchangeable jaw inserts, will handle taps, splices, deadends for copper or aluminum through size 1/0 ACSR—or 2/0 for the Hysplices.

Tremendous force — 9,000 lbs. developed by combined cam and lever action—plus the simple change of die inserts—give the MD-4 a versatility never before achieved in a tool of such light weight and low cost.

Accessories include an insulating neoprene cover for the Hytool head, and a canvas carrying bag or steel case. Write Burndy for details.

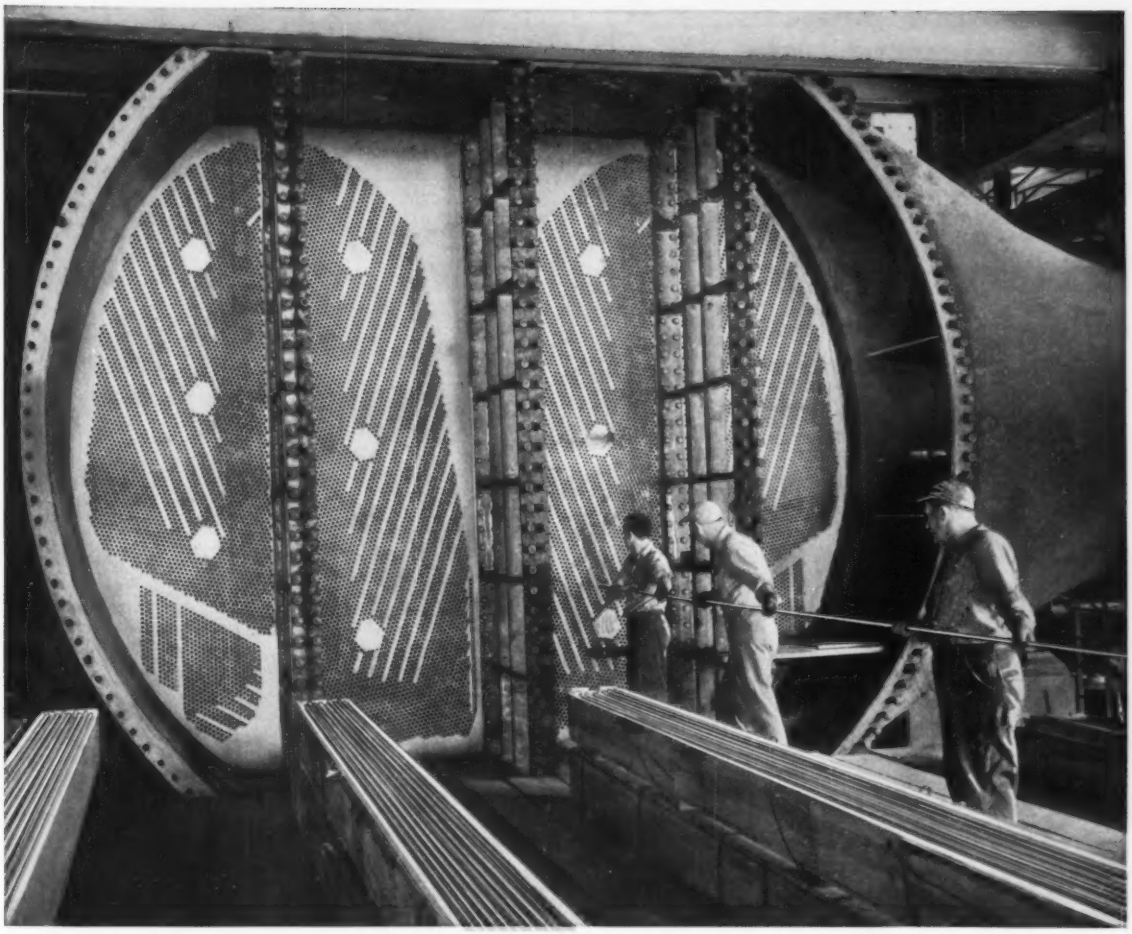
Die inserts can be changed in less than a minute.

Aligning pins position the jaws – set screws, lock them in place.

BURNDY

56-9

Norwalk, Connect. • Toronto, Canada • Other Factories: New York, Calif., Toronto • Export: Philips Export Corp.



IN FOR A BIG HEAT-TRANSFER JOB

...AND MANY YEARS OF SERVICE FROM

CHASE® ANTIMONIAL ADMIRALTY TUBE!

Remove 988 Btu's per pound of steam! Condense 1,046,830 pounds of steam per hour! Cool with raw lake water! That's the job of a single-pass condenser for a Great Lakes power and light company.

And Chase Antimonial Admiralty was selected for the condenser tubes in this installation with many years of trouble-free service anticipated. You see, Chase Antimonial Admiralty condenser tubes have *virtually eliminated* tube failures caused by dezincification. Perfect alloying and tempering provide freedom from season cracking and permit easy rolling into tube sheets. And rigid quality controls at the mill assure tube as flawless as science can make it.

Make sure your new and replacement condenser tube installations will *really* give long service. Insist on Chase Antimonial Admiralty!

Chase®

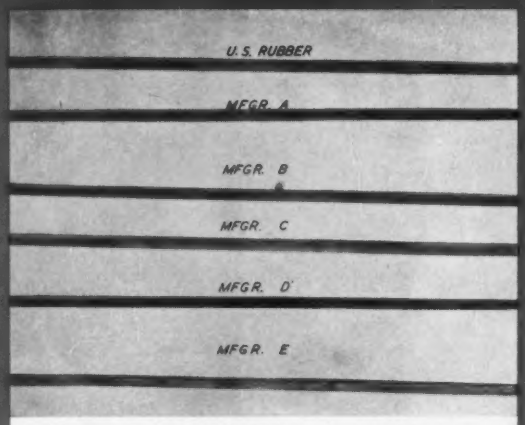
BRASS & COPPER CO.

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

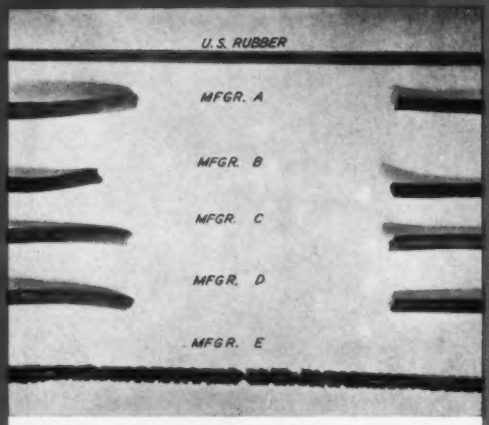
The Nation's Headquarters for Brass & Copper

Atlanta • Baltimore • Boston • Charlotte • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Grand Rapids • Houston • Indianapolis • Kansas City, Mo. • Los Angeles
Milwaukee • Minneapolis • Newark • New Orleans • New York • Philadelphia • Pittsburgh • Providence • Rochester • St. Louis • San Francisco • Seattle • Waterbury

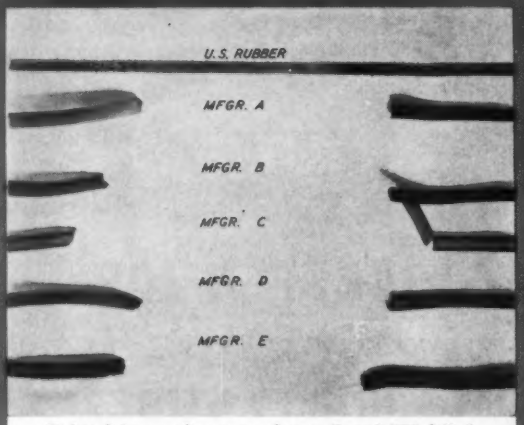
Grizzly High Voltage Power Cables



Here are 6 samples of widely used competitive neoprene jackets (stretched 200% of original length) at start of test for ozone resistance.



2 hours, 23 minutes after start. Brand "E" is disintegrating. Brand "B" has failed 13 minutes ago; the other brands failed an hour or more before.



Taken 7 hours after start of test—Brand "E" failed after 2 hours, 30 minutes. U. S. Grizzly Power Cable's jacket showed practically no sign of damage. It did not fail until after 18 hours of exposure.

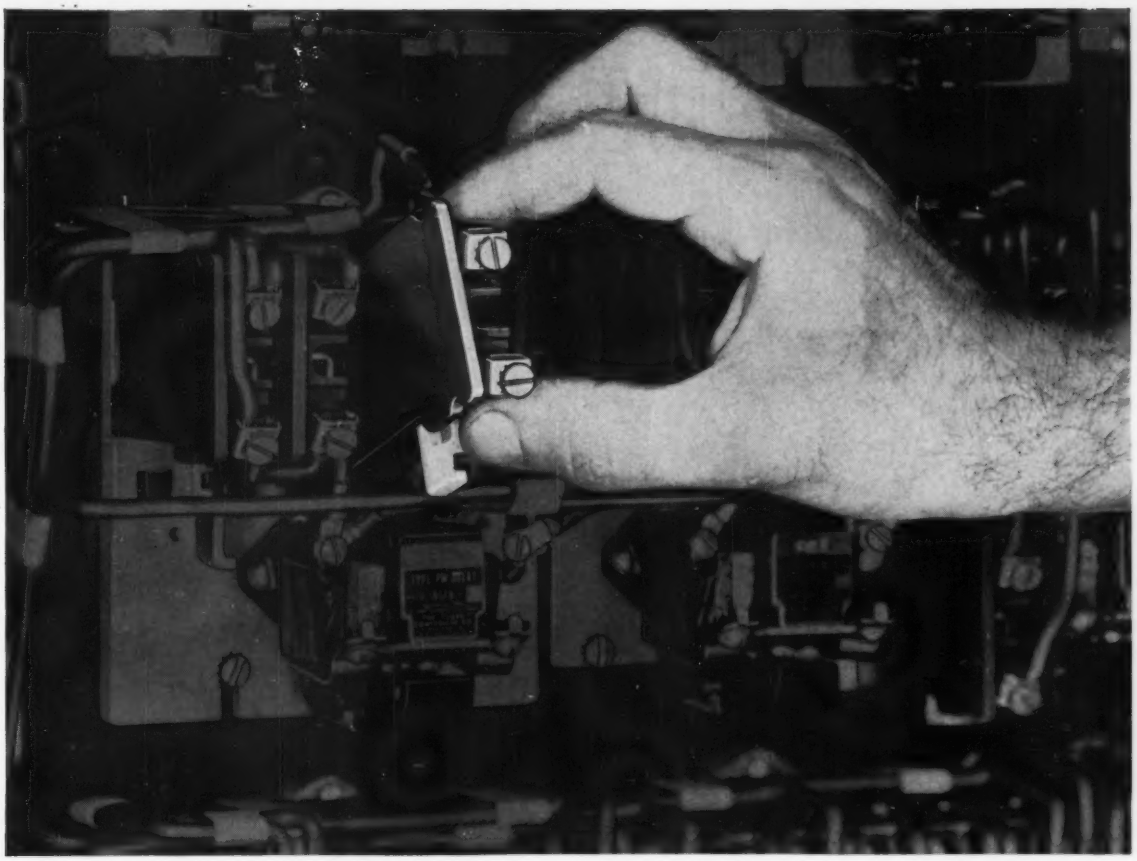
Proved far and away the winner in an Ozone test of 6 leading competitive jackets!

U. S. Grizzly® High Voltage Power Cables are unmatched in performance, durability and all-around economy. Order these superior cables from your "U. S." branch, distributor or write Electrical Wire & Cable Department, United States Rubber Company, Rockefeller Center, New York 20, N. Y.

Obsolete wiring can cause power failure, step up expense and push down your production. That's why it's important to make sure your plant is equipped with Adequate Wiring—adequate not only for today's needs but also for the increased electrical loads needed in your future growth.

Electrical Wire & Cable Department

United States Rubber

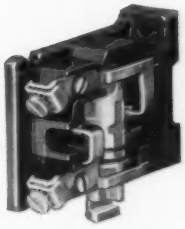


You can easily remove a single pole from any CLARK Type "PM" Relay

Each pole in the new CLARK heavy-duty relays is an integral unit that can be quickly removed or replaced *from the front* without disturbing other poles. You need disconnect only two wires and loosen one mounting screw—regardless of the number of poles in the relay. Compare this with other types of relays where the whole device must be removed to accomplish the same thing. For example, with a conventional 6 pole relay, 14 wires and 3 mounting screws must be removed.

All terminals are located on the front. They are "pressure" type, eliminating need for looping wire. Coil-changing and magnet replacement can also be done quickly from the front without removing relay from panel.

Write for Bulletin PL-7305



Each pole is contained in its own melamine housing.

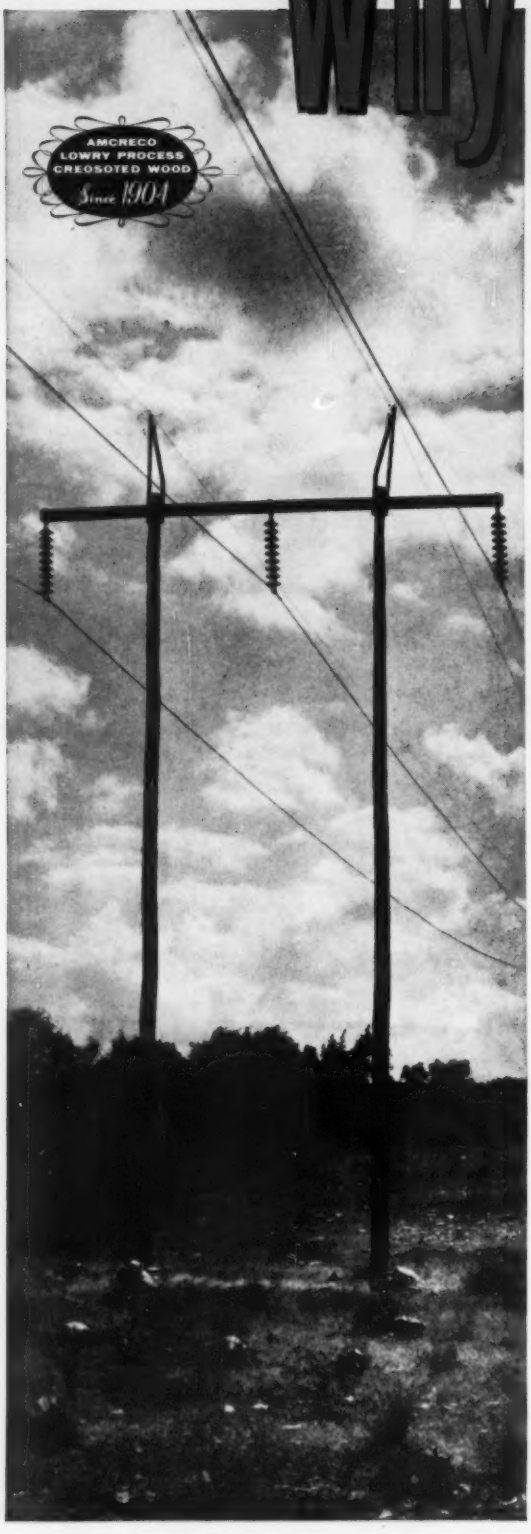
A short circuit through one set of contacts is confined to a single pole and will not destroy the whole relay. Enclosed top protects from dust and dirt, and serves as wiring shelf.

The **CLARK CONTROLLER** *Company*

Engineered Electrical Control

1146 East 152nd Street • • Cleveland 10, Ohio

IN CANADA: CANADIAN CONTROLLERS, LIMITED • MAIN OFFICES AND PLANT, TORONTO



Why do you invest money in treated woods?

The basic reason why you invest money in treated poles, cross arms, conduit and other construction woods is because they last longer. You know that every dollar spent on properly treated wood products will save you many, many dollars later on in pole renewals, cross arm replacement and other repair and maintenance work.

The first question that you must ask yourself when investing in treated woods is, "Just how much will this particular preservative or process increase the service life of our wood?"

With Amcreco Creosoted Products, that question has been answered. Wood, pressure treated with creosote by Amcreco, lasts for years and years with great strength throughout the life of the wood, and with high resistance to fungi, borers, insects and all natural enemies of wood.

Write our nearest office for estimates or quotations on treated poles, cross arms, conduit, timbers and other construction woods. We would appreciate an opportunity to quote on your needs.

AMERICAN CREOSOTING COMPANY

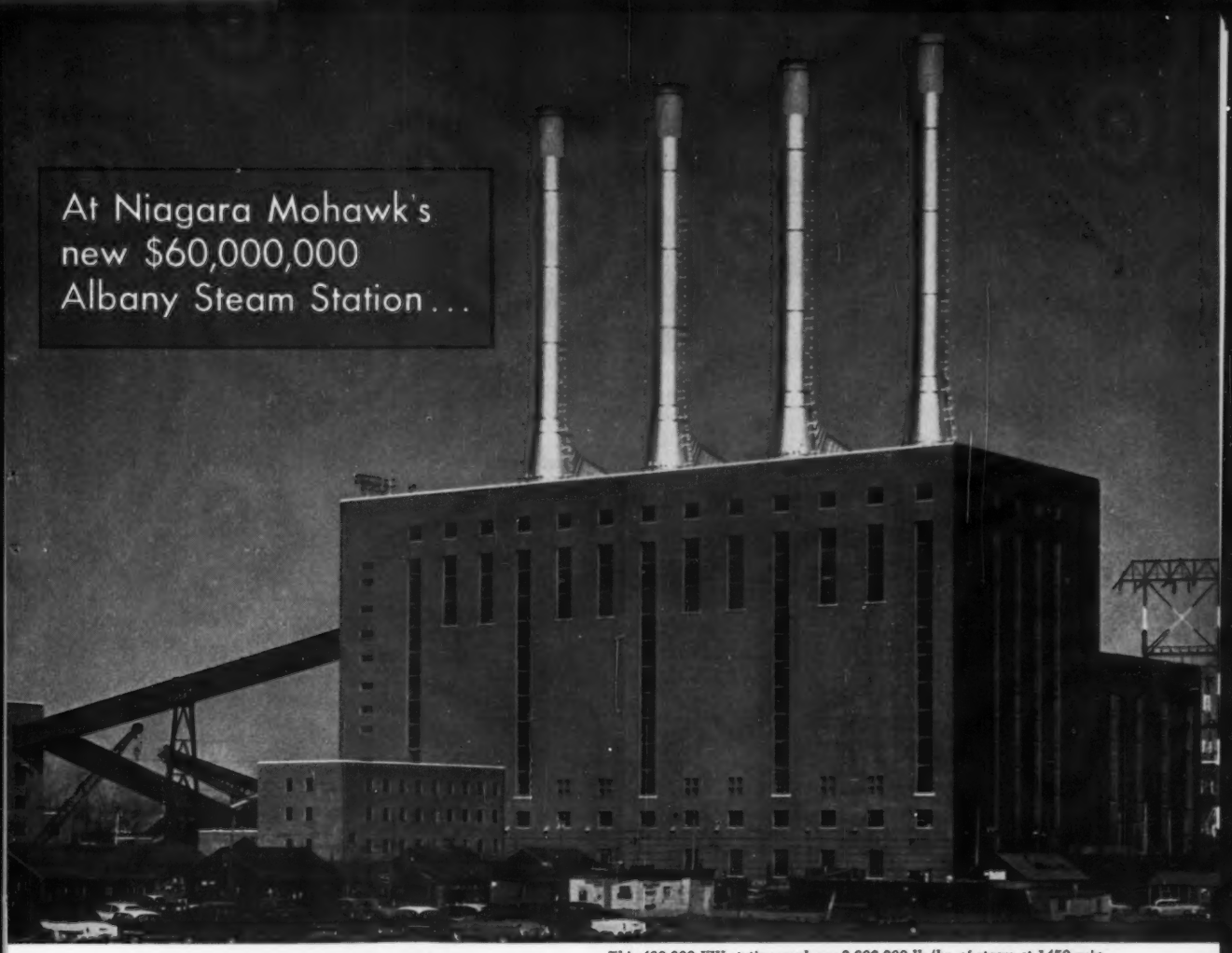
Colonial Creosoting Company
Federal Creosoting Company
Indiana Creosoting Company

AMCRECO
LOWRY PROCESS
CREOSOTED WOOD

Gulf States Creosoting Company
Georgia Creosoting Company
Kettle River Company

Georgia Forest Products Company

GENERAL OFFICES: LOUISVILLE 2, KENTUCKY
12 FIELD SALES OFFICES TO SERVE YOU



This 400,000 KW station produces 2,600,000 lb./hr. of steam at 1450 psig.

Permutit Demineralizers deliver highest quality make-up... and save money, too!

Albany Station's Mixed-Bed Demineralizer was guaranteed to produce make-up of not over 0.5 ppm total solids (about 1 micromho in conductivity), silica of not over 0.1 ppm. It is consistently delivering *better* make-up—0.1 to 0.3 micromhos in conductivity, silica of 0.03 ppm.

Operators are enthusiastic! They like the availability of this Permutit Demineralizer. It is independent of the heat cycle—supplies plenty of make-up for filling a boiler after a shutdown, delivers water at low loads when evaporators would not be available.

Automatic Regeneration saves money! High-capacity Permutit ion exchange resins require fewer regenerations. Motor-driven valves automatically backwash and separate the two resins, individually regenerate and rinse the beds, evenly blend the resins and return the unit to service. Operators have only to keep charges of regenerating chemicals ready.

For performance and cost data on this installation or aid in solving your water problem, write The Permutit Company, Dept. EW-4, 330 West 42nd Street, New York 36, N. Y., or Permutit Company of Canada, Ltd., 5500 Royalmount ave., Montreal, Que.

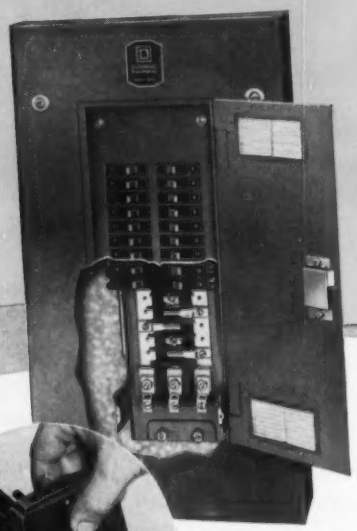
WATER CONDITIONING HEADQUARTERS

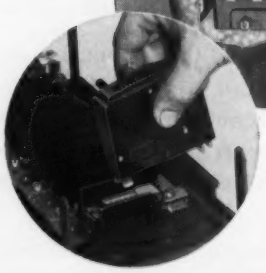
PERMUTIT®

QO FINEST BREAKER EVER BUILT . .

Since the QO panelboard breaker was introduced a little more than a year ago, Square D Field Engineers have been proving its absolute superiority in thousands of demonstrations to contractors, architects, engineers and inspectors. Even more conclusive—it has been proving itself by actual performance in Square D's Type NQO panelboards.

Now, a new circuit breaker plant using the latest automation techniques makes the availability of this panelboard breaker possible in moderately priced load centers!





At left, above • Demonstration Unit with which Square D Field Engineers prove that QO really is the finest breaker ever built!

At right • Square D's NQO panelboard featuring the QO breaker with exclusive *SWINGRIP* mounting. Easier installation, automatic alignment and positive contact with bus bars.

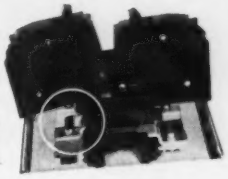
SQUARE D COMPANY

. . . NOW IN LOAD CENTERS!

2 through 42 Circuits

You can't go wrong!

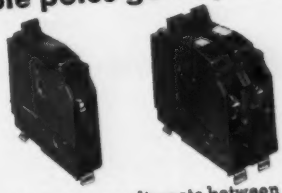
Projections on the insulated barriers prevent installation of wrong amperage breakers unless the barrier is modified. This modification is simple and can be done with a twist of the wrist.



Want to Lock It?

The spring catch can be replaced by a flush panel type lock, shown at left, by simply removing a twistout. This lock may be "keyed" to match Square D panelboards.

Double poles go anywhere!



Shielded connectors alternate between buses, giving distributed (sequenced) phasing. As a result, two pole common or individual trip breakers can be plugged in anywhere.

A complete line of load centers for residential, commercial and light industrial applications is already on your Square D distributor's shelf. Available with doors in 12, 20, 30 and 42 circuit basic devices—1 phase, 3 wire; or 3 phase, 4 wire. Lugs only, split bus or main breaker types. Flush, surface and raintight enclosures. UL approved and meets Federal Specifications WP-131A, Class A.

2 through 8 Circuits

For services requiring less circuits, a line of 2, 4, 6 and 8 circuit basic devices, without doors, for 1 phase, 2 wire; or 1 phase, 3 wire. Flush, surface and raintight enclosures. (8 circuit device shown at right)

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

STRONGER THAN THE PIN

In laboratory tests to determine the torsion strength of Kimble *Tempered* Glass Insulators, wood pins were sheared off, and lead-bushed threads stripped, with no failure of the Insulators. Cantilever tests using special alloy pins were discontinued at 10,000 lbs. with still no failure. Ultimate impact tests averaged 130 inch pounds!

Kimble *Tempered* Glass Insulators save installation time because it's never necessary to loosen for lineup with the conductor. Their great strength always allows another quarter-turn.

If it's on the pin, it's in service

Tests far in excess of A.I.E.E. standards have proved it impossible to puncture a Kimble *Tempered* Glass Insulator in air. Even lightning surges have failed to damage them. In the event of shattering due to severe mechanical shock, insulator disintegrates into small, non-sharp fragments. Trouble shooters can locate broken insulator—fast.

What's the secret? *Tempering*, a Kimble development in glass insulators that adds a new element to the many natural virtues of glass insulators. Kimble insulators are more than strong enough to meet the severe tests required.

Why not see how *tempered* glass can cut your line maintenance costs. Write for descriptive folder that gives complete details. Address: Kimble Glass Company, subsidiary of Owens-Illinois, Dept. EW-4, Box 1035, Toledo 1, Ohio.

KIMBLE INSULATORS
AN (I) PRODUCT

OWENS-ILLINOIS
GENERAL OFFICES · TOLEDO 1, OHIO

The "General" commands an army of experts,
backed by expanding resources.
He is at your service.

General Cable... *at your service!*

LIVE BETTER . . . ELECTRICALLY!

GENERAL CABLE CORPORATION, 420 LEXINGTON AVE., NEW YORK 17 • OFFICES AND DISTRIBUTION CENTERS COAST-TO-COAST

NEW SUPERCHARGED

developed by Foster Wheeler

offers FIVE IMPORTANT

FOSTER WHEELER has developed a new supercharged boiler of far-reaching significance to the power industry.

In the supercharged cycle, diagrammed schematically on the facing page, high pressure combustion gases leaving the boiler are used to drive a gas turbine which, in turn, compresses combustion air for the boiler and drives an auxiliary generator. Spent gases from the turbine pass through an economizer and thence to the stack.

The following advantages are inherent in this supercharged boiler cycle.

1. There is a marked increase in overall plant economy. When utilizing maximum gas turbine operating temperatures, net power developed by the gas turbine can run as high as 15% of total plant output, with an overall gain of 10% in cycle economy. Even when operating at lower exit-gas temperatures, where the gas turbine is used only to drive the compressor, cycle economy is increased by the amount of power that would otherwise be required for operating the fans of a conventional boiler.

2. The supercharged boiler permits a rather astounding reduction in size and weight, due to much higher heat absorption rates. A supercharged boiler may weigh from ½ to ¼ as much as a conventional boiler of equivalent capacity. This, of course, permits a substantial saving in first cost—as much as 25% or more, depending on cycle conditions.

3. Start-up time is extremely short compared to that of a conventional steam generator.

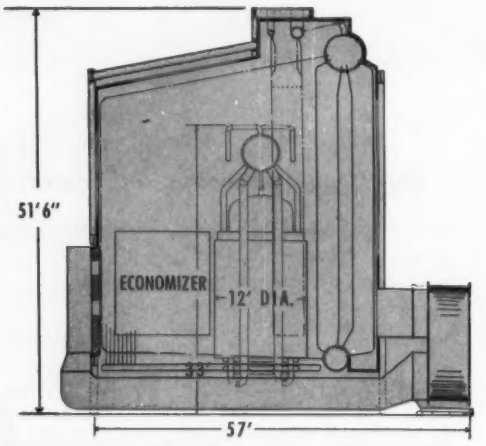
4. The supercharged boiler responds much more quickly to load changes.

5. Boilers can be completely shop fabricated and shipped ready to install.

To obtain the design symmetry essential for this pressurized firing service, the boiler drum is mounted separately above the boiler furnace—connected to it by external risers and downcomers. The furnace is fully enclosed with waterwall surface and a metal baffle separates the furnace tubes from the convection section. Superheated pancake coils are located in the base of the firing chamber.

Foster Wheeler has built three of these supercharged boilers and a fourth is now under construction. At present, units can be furnished for natural gas or light fuel firing.

For complete information on this important Foster Wheeler development, send for a copy of the December issue of "Heat Engineering". *Foster Wheeler Corporation, 165 Broadway, New York 6, N.Y.*



Comparison of physical dimensions of a conventional boiler (gray) and supercharged boiler (red). Both units are designed to furnish steam at 1200 psi, 950F for a 43,000 kw station.

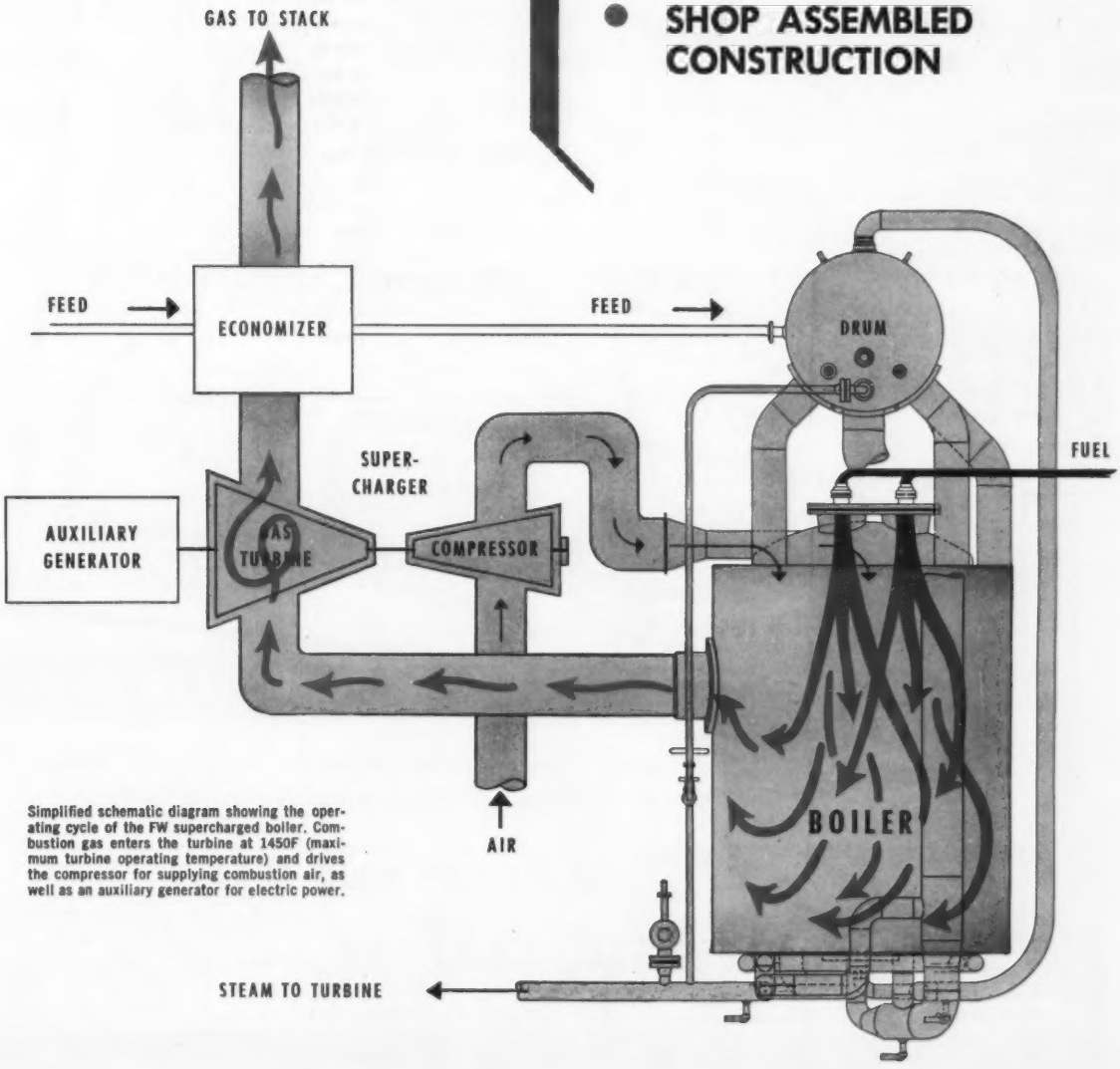
FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

BOILER

ADVANTAGES...

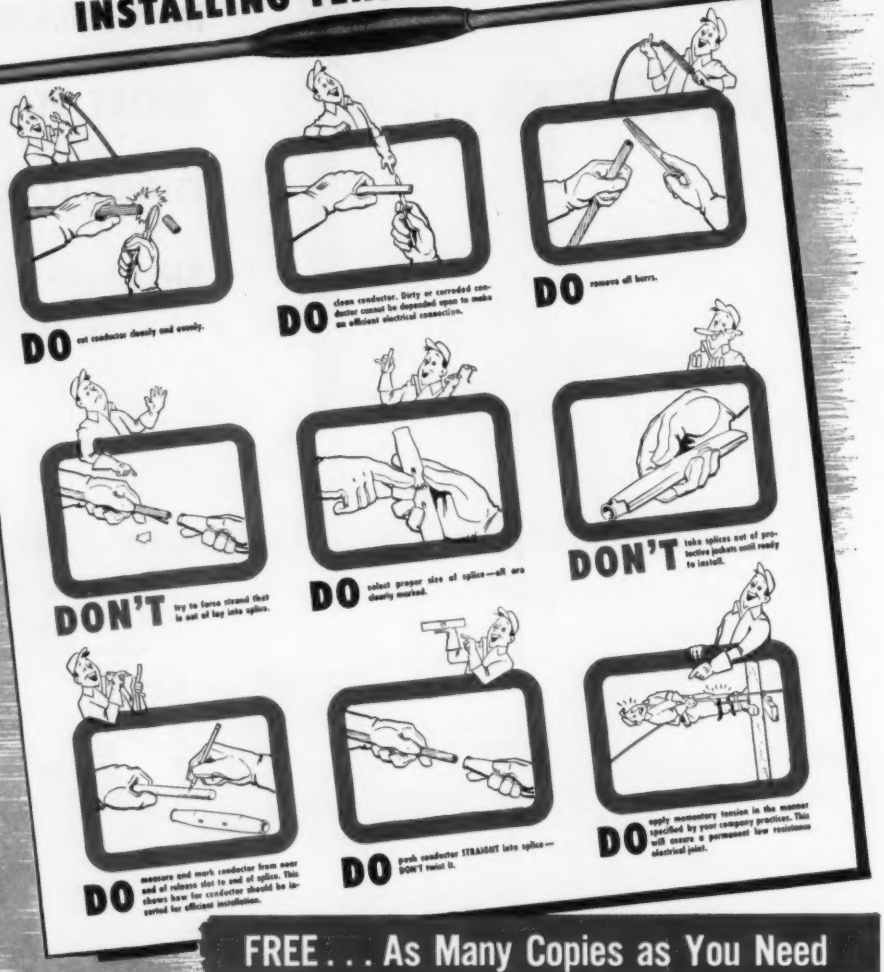
- HIGH OVERALL ECONOMY
- DRASTIC REDUCTION IN SIZE AND WEIGHT
- SHORT STARTING TIME
- QUICK LOAD RESPONSE
- SHOP ASSEMBLED CONSTRUCTION



Simplified schematic diagram showing the operating cycle of the FW supercharged boiler. Combustion gas enters the turbine at 1450F (maximum turbine operating temperature) and drives the compressor for supplying combustion air, as well as an auxiliary generator for electric power.

BE SURE YOUR LINEMEN KNOW the

DO'S and DON'TS for INSTALLING TENSION SPLICES


DO cut conductor cleanly and evenly.
DO clean conductor. Dirty or corroded conductor cannot be depended upon to make an efficient electrical connection.
DO remove all burrs.
DON'T try to force stranded that is out of lay into splice.
DO select proper size of splice—all are clearly marked.
DON'T take splices out of protective jackets until ready to install.
DO measure and mark conductor from near end of release slot to end of splice. This shows how far conductor should be inserted for efficient installation.
DO push conductor STRAIGHT into splice—DON'T twist it.
DO apply momentary tension in the manner specified by your company practices. This will assure a permanent low resistance electrical joint.

For Thoroughly Efficient Installation of TENSION SPLICES

FREE . . . As Many Copies as You Need

to hang where your linemen can see them. This 17" x 22" two color poster carries no advertising . . . It is issued as a service to the industry.

WRITE FOR YOUR SUPPLY TODAY!

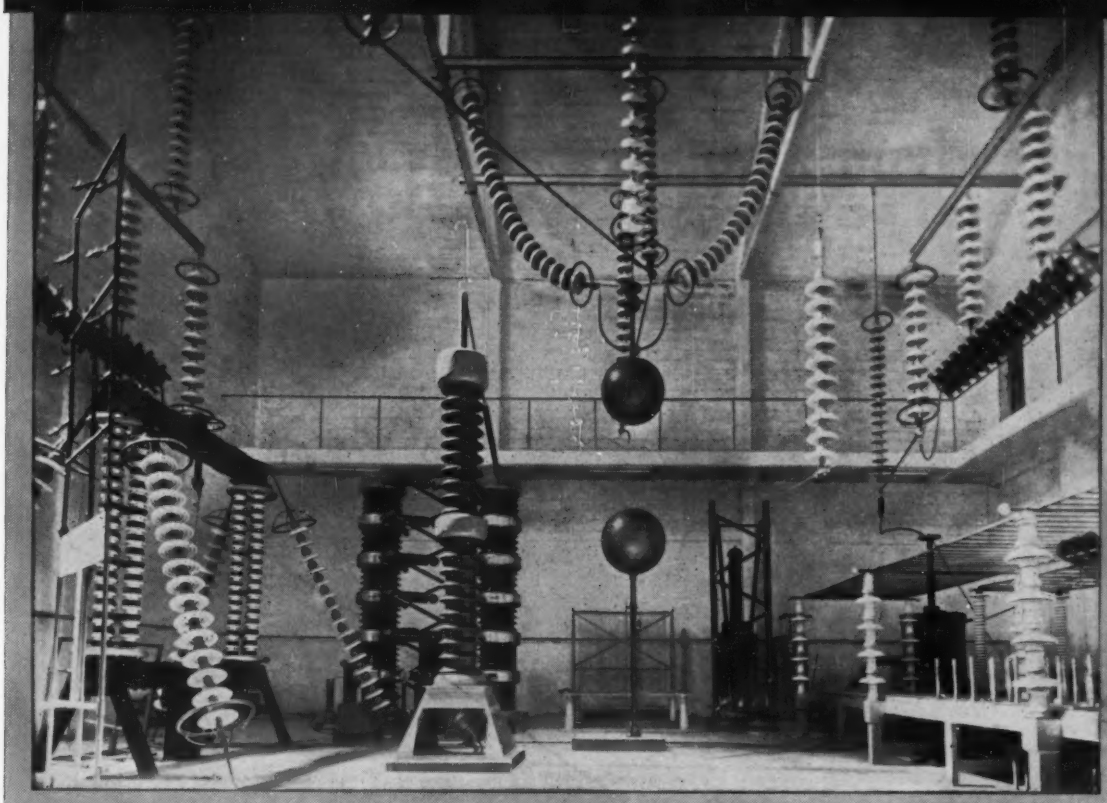
Reliable ELECTRIC COMPANY 3145 CARROLL AVENUE CHICAGO 12, ILLINOIS

OVER 45 YEARS OF SERVICE TO THE UTILITIES

[illegible] CONNECTORS AND CONSTRUCTION [illegible]

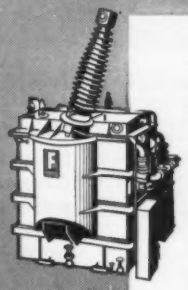
FERRANTI

HIGH VOLTAGE TESTING EQUIPMENT



ARGENTINA

A 1,000,000 volt Ferranti Impulse Generator installed in the Laboratories of Fabrica de Porcelana Armanino, Buenos Aires, Argentina.
This equipment produced the first ever 1,000,000 volt arc in Argentina. Ferranti have also supplied to the same customer a 500,000 volt, 250 kVA, A.C. Testing Equipment.



FERRANTI

TRANSFORMER CAPACITY OF OVER 5,000,000 kVA per annum

The Ferranti transformer plant at Hollinwood, Lancashire, England, covering an area of over 300,000 sq. ft. has a manufacturing capacity per annum of over 5,000,000 kVA of Large Power Transformers, Distribution Transformers, Voltage Regulators, High Voltage A.C., D.C., and Impulse Testing Plant and Specialised Equipment. Contracts include the supply of transformers for the Garrison Dam and McNary Dam Projects in the U.S.A. and the Alcan Project in Canada.

FERRANTI LTD

Head Office and Plant : HOLLINWOOD, LANCASHIRE, ENGLAND

FT.162/F

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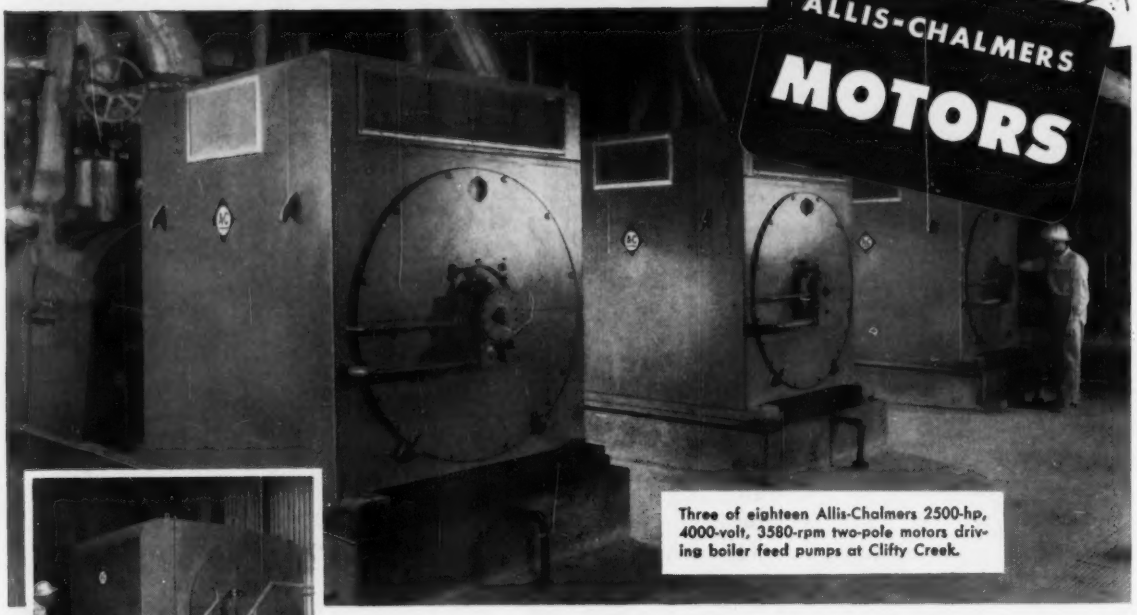
NEW YORK : Ferranti Electric Inc, 30 Rockefeller Plaza, New York 20, N.Y.
TORONTO : Ferranti Electric Ltd., Mount Dennis, Toronto 15, Ontario.
MANCHESTER, ENGLAND : Ferranti Ltd., Moston, Manchester, 10.
EDINBURGH, SCOTLAND : Ferranti Ltd., Ferry Road, Edinburgh 5.

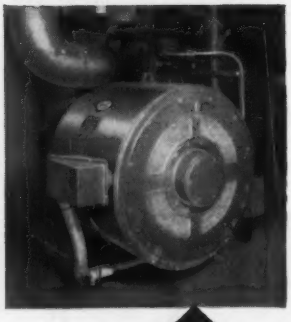
Furnishing Major Auxiliary Drive Power

at Indiana-Kentucky Electric Corporation's Clifty Creek Plant



Three of eighteen Allis-Chalmers 2500-hp, 4000-volt, 3580-rpm two-pole motors driving boiler feed pumps at Clifty Creek.

Rooftop installation of Allis-Chalmers 1500-hp, 4000-volt, 1185-rpm weather-protected motors. This is one of twelve Allis-Chalmers motors giving dependable service driving forced-draft fans at this modern new plant.



Allis-Chalmers 250-hp flange-mounted motor driving plant air compressor. This unusually economical mounting method for such a large motor can be attributed to Allis-Chalmers experience in motor applications throughout the electric power industry.

A wide variety of Allis-Chalmers motors furnish most of the major auxiliary drive power at Clifty Creek Plant near Madison, Indiana. Allis-Chalmers motors are driving plant air compressors, coal handling equipment, forced-draft fans, boiler feed pumps and many other pumps.

The Allis-Chalmers motors at this Indiana-Kentucky Electric Corporation installation are just a few of the complete line of motors Allis-Chalmers builds for power plant service. Contact the Allis-Chalmers district office in your area, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin, for complete information.

A-4956

Now, You Can Get Even Greater Winding Protection with SILCO-FLEX

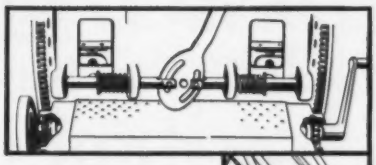
all-silicone-rubber motor insulation. Available only on Allis-Chalmers motors — in many of the larger sizes. Ask your A-C representative for the facts about this revolutionary new insulation system.

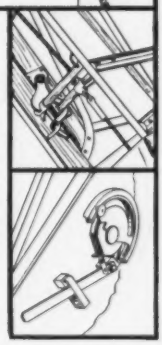
Silco-Flex is an Allis-Chalmers trademark.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

Series 2200 Ladder elevates to 72°, rotates 360°. Available in 24, 28 and 32-foot ground-to-platform heights.





SAFETY FIRST

Here are a few of the many safety features on the Holan 2200 Ladder: Top — Cam-operated, spring-loaded pins with automatic safety lock to prevent disengaging from gear sectors when fly section is extended; Middle — Heavy-duty lock hooks for engaging two rungs at a time; Bottom — Band-type brake on windlass for absolute control of ladder retraction.

Reach for the sky ...FAST!

Two-and-a-half turns of the elevation crank and this Holan 2200 Mechanical Ladder is at the maximum 72° angle. And it doesn't take a muscle man to do it. Elevation and rotation are fast and easy because of center spring counterbalancing and worm and gear turning. Fly ladder extension and retraction is easy, too... just turn the handwheel. In other words, the mechanical equipment does the hard work — not the operator. Some other Series 2200 features: Rigid truss design with fabricated end sections; strong, easy-to-replace rungs; automatic storage lock for travelling; and optional Duo-Level Platform with two adjustable standing surfaces.

Write us for complete information about the 2200 Ladder, Series 2100 All-hydraulic Ladder, and Series 2500 Manually-operated Hydraulic Ladder.

Line construction bodies for light to heavy-duty. Crew compartments optional. Efficient tool compartments and drawers.

Bodies for truck driven air compressors. Designed to accommodate hose reels, tapping machines, jack hammers, etc.

Service bodies for chassis up to 1½ ton. Lengths, 72", 75", 84", 90" and 102".

Hydraulic Derricks designed for front or rear mounting. Capacities to 12,000 lbs.

Light-duty power operated derricks for front or rear mounting. Operating range of 146°.

Ladders to 40' with all phases completely hydraulic. Pump actuated by P.T.O. or separate engine drive with electric starter.

Mechanical Ladders expertly engineered and counterbalanced for effortless handling. Maximum heights from 23' to 40'. Swings 360°; angles to 72°.

Portable hydraulic and mechanical earth borers. Augers for 8" to 20" diameters, depth to 8'.

Wide variety of pole and reel trailers. Standard and special. Many optional features.

Hydraulic jacks, controlled from rear of truck. Rigid mounted or patented Holan self-stowing types.

Hydraulic towers with rotary, stationary, or transverse platforms. Exclusive box-girder telescoping mast.

J.H. HOLAN CORPORATION

4100 WEST 150TH STREET
CLEVELAND 11, OHIO

OTHER PLANTS:
HOLAN CORPORATION OF GEORGIA, Griffin, Ga. • J. H. HOLAN CORP., Phoenix Div., Arizona
BRANTFORD-HOLAN LIMITED, Brantford, Ontario

THE NAME THAT MEANS WORK SIMPLIFICATION

Never leave
dependability
out of your fuel picture

A sailboat has no choice—it must depend upon an undependable wind for locomotion. Fortunately, you have a choice in fuels for your firing system. Select the fuel known for *complete* dependability—Bituminous coal! It's the one fuel which gives you:

Dependability of Supply—Bituminous coal provides, for centuries to come, an inexhaustible source of low-cost heat and energy. The vast Bituminous fields served by the B&O contain a great variety of outstanding coals for every purpose.

Dependability of Cost—Cost is kept low and stable thanks to the advancements made by modern mechanized mining. And coal is economical and safe to store.

Call on our Coal Technical Service! You will receive authoritative information on how to select the right Bituminous coal for your specific firing job . . . how to make the most of your fuel dollar. *Ask our man!*

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BALTIMORE & OHIO RAILROAD
BALTIMORE 1, MARYLAND

BITUMINOUS COALS FOR EVERY PURPOSE

BALTIMORE & OHIO RAILROAD
Constantly *doing things*—better!

LINKING 13 GREAT STATES WITH THE NATION B&O

ROEBLING PAPER POWER CABLE WITH TELLURIUM LEAD ALLOY SHEATH

YOU WANT

- *MAXIMUM FATIGUE RESISTANCE;*
- *SUPERIOR STABILITY UNDER HEAT;*
- *HIGH BURSTING STRENGTH;*
- *ABOLITION OF THE NEED FOR FREQUENT STOP JOINTS, REINFORCED LEAD SHEATH, GENEROUS EXPANSION BENDS, LARGE MANHOLES;*
- *LOWEST LONG-TIME CREEP RATE;*
- *THE RELIABILITY ASSURED BY OUR EXCLUSIVE MANUFACTURING, TESTING AND FIELD EXPERIENCE...*

IN SHORT,

YOU WANT

ROEBLING

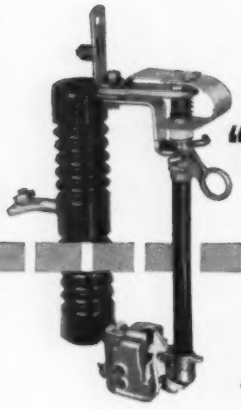
Subsidiary of The Colorado Fuel and Iron Corporation

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J. BRANCHES: ATLANTA, 934 AVON AVE. • BOSTON, 11-15 STILLING ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 3253 FREDONIA AVE. • CLEVELAND, 13335 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1920 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • PITTSBURGH, 1723 HENRY W. OLIVER BLDG. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST AVE. S. • TULSA, 331 N. CHEYENNE ST. • EXPORT SALES OFFICE, 19 RECTOR ST., NEW YORK 6, N. Y.

Now...clear 12000 amps

WITH AN OPEN CUTOUT

AT ONLY "EXTRA HEAVY DUTY" COST



S&C's Open Cutout—Type XS—with a newly developed fuse tube—provides the higher interrupting capacity needed on some of your distribution feeders . . . without sacrificing linemen's safety . . . without double-venting . . . without resorting to an oversize bore . . . and without a cost premium.

This high interrupting capacity is achieved through two new developments which result in (a) minimizing the energy developed within the fuse tube and (b) absorbing this reduced energy in a unique recoil mechanism. Low fault interruption has not been sacrificed either. It is assured by a strong, fast-acting flipper.

Specialists in High-Voltage Circuit Interruption since 1910

Handles lightest faults, too!

Re-usable extension rod shortens arc length, reduces gas generation
S&C Positrol Fuse Link permits precise system co-ordination
Strong, canvas-base bakelite backs up fiber liner
30

RATINGS

	Amperes	
KV	Continuous	Interrupting (RMS, Asymmetrical)
7.5	100	12000
15	100	10000

S&C ELECTRIC COMPANY

4421 RAVENSWOOD AVENUE • CHICAGO 40, ILLINOIS, U. S. A.

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POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

ELECTRICAL BUSINESS OUTLOOK

Electrical World
APRIL 16, 1956

Steel prices are expected to take a record jump this summer. Recent increases in freight rates, iron ore and steel scrap prices in major steel centers are already building up pressure. The deciding factors, however, will be the industry's ambitious plans to add 15 million tons of new capacity in the next three years and the certainty of higher labor costs later this year. Experts expect these factors to boost prices more than $9 a ton.

Utilities will pay an extra $1 to $1.50 for every kw of new capacity if steel goes up $9 a ton. That's how much would be added to the average $16 per kw it now costs for steel in new generating stations. With 6.7 million kw of new steam capacity scheduled for 1957 the industry could find its costs jumping anywhere from $6.7 to $10.1 million.

• • •

REA Co-ops will pour $1 billion into new and improved facilities over the next five years. This is the same amount spent in the past five years. Rural Electrification Administration's survey of financial needs of borrowers for fiscal 1957 through 1961 showed expected expenditures at $805 million. REA kicked this up to $1 billion since estimates for future years are usually low.

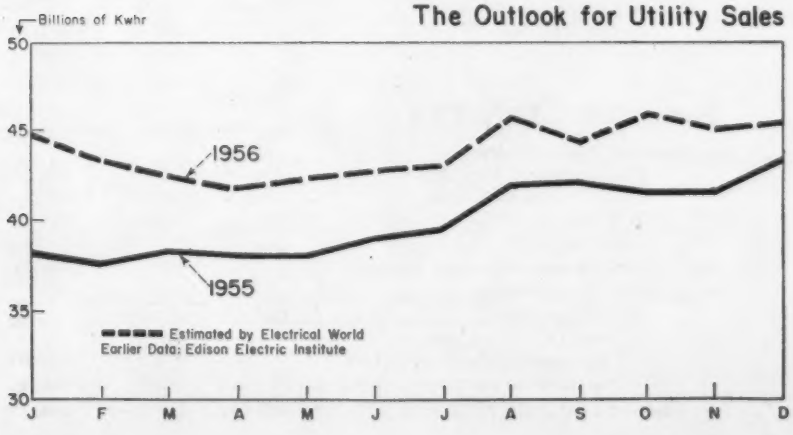
Co-op expenditures will hit $193 million in fiscal 1957. Totals for remaining years are: 1958—$185 million, 1959—$142 million, 1960—$135 million and 1961—$150 million. Chances are that actual expenditures in later years will stay near the $.2 billion average for the past five years.

Even so, Co-op spending as a percentage of the utility industry's total construction program shows a steady decline over the next five years. In 1956 Co-ops will spend only 4.9% of the $3.9 billion reported in Electrical World's Construction Survey (Jan. 23, 1956). Assuming Co-op spending stays at $193 million here's how it stacks up against EW's industry forecast for the remaining years: 1957—4.6%, 1958—3.8%, 1959—3.6% and 1960—3.6%.

• • •

Consumers Power Co is betting on continued good times by planning a 46% increase in generating capacity by 1960. CP's five year construction program—which will add 718,750 kw to the system—calls for expenditures totalling $½ billion—the same amount invested in the ten years ended in 1955.

The Outlook for Utility Sales



STATISTICS

U.S. Peak Demand Jumped 17.6% in November 1955

(% Change in 1955 Peak Demands Over 1954)

REGIONS	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
I	3.6	7.4	7.3	6.8	7.7	5.3	10.5	10.3	5.8	5.4	11.1	10.0
II	8.8	13.0	14.5	18.6	21.1	20.5	27.0	26.4	23.7	27.0	28.4	24.7
III	15.2	21.7	19.2	16.3	19.8	19.3	21.3	19.2	18.2	19.2	23.8	18.4
IV	7.3	11.0	10.6	9.3	10.4	6.5	11.3	11.5	10.0	6.1	11.1	10.5
V	5.7	8.6	8.2	10.0	15.6	5.3	6.7	11.4	8.0	7.9	16.5	12.8
VI	12.2	15.7	11.2	9.9	15.1	6.7	13.2	15.5	8.2	6.1	11.6	12.9
VII	5.1	8.1	9.7	9.1	9.3	9.5	9.7	12.2	16.8	16.5	18.5	15.0
VIII	7.2	9.4	8.6	9.8	6.7	5.1	4.4	8.8	12.7	10.3	11.5	9.6
TOTAL U.S.	7.8	11.9	11.6	11.7	13.4	10.8	14.2	15.0	13.4	13.3	17.6	14.9

Source: Edison Electric Institute

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	Feb.	115.59	114.55	103.74	11.4
Peak—Class I Systems (million kw)	Jan.	95.8	98.2	84.1	13.9
Estimated Dec. '56 Peak (million kw)	Jan.	105.45	105.27	102.56	2.8
Production—billion kwhr	Feb.	47.99	51.12	40.23	19.3
Hydro		10.63	9.36	8.57	24.0
Fuel		37.36	41.76	31.66	18.0
Sales—billion kwhr	Dec.	45.19	43.07	38.06	18.7
Residential		12.25	10.71	10.89	12.5
Commercial		6.81	6.61	6.19	10.0
Industrial		23.75	23.37	18.75	26.7
Other		2.39	2.38	2.23	7.2
Fuel Consumption	Feb.				
Coal—million tons		13.44	15.22	11.09	21.2
Oil—million barrels		7.10	8.22	7.43	−4.4
Gas—billion cu ft		67.81	68.27	63.63	6.6
Net Income Class A & B Co's—$ million	Jan.	127.26	125.72	112.21	13.4
Residential Customers—millions	12 mos.	44.41	44.30	43.14	2.9
Revenue per kwhr	ended	2.64¢	2.65¢	2.69¢	−1.9
Avg kwhr per customer	Dec. 31	2,751	2,728	2,549	7.9
Avg annual bill		$72.63	$72.29	$68.57	5.9

Business Statistics . . .

Indexes: 1947—49 = 100					
FRB Industrial Production	Feb.	144	143	135	6.7
ENR Construction Cost	Mar.	142.8	142.6	135.4	5.5
BLS Cost-of-living	Feb.	114.6	114.6	114.3	0.3
NEMA Sales	Jan.				
Insulation materials		159	160	132	20.5
Electric appliances		105	101	108	−2.9
Wholesale prices	Dec.				
Motors and generators		127.2	127.0	121.8	4.4
Transformers and regulators		129.2	129.2	128.1	0.9
Switchgear and fuses		145.9	145.9	135.3	7.8
GNP—annual rate—$ billion	4th Qtr.	397.3	392.0	367.1	8.2

Your Business

What are people in our industry reading? Curious about this we decided to conduct a straw poll. And if nobody'll pin us down on figures, here's what we turned up:

Consolidated Edison's top executives are enthusiastic about "Great Enterprise," by Herrymon Maurer. The book is based on a study of management policies, procedures, and philosophies of 50 large American corporations. The book, we understand, is almost "must" reading in Con Ed.

Out on the Coast, Southern California Edison reports that "Atomic Power," a non-technical discussion of the uses of atomic energy by the editors of Scientific American, is recommended reading for all top personnel. Other popular titles are: "Andersonville," by MacKinlay Kantor; and Anne Lindbergh's "Gifts From the Sea." Pacific G&E is enjoying "Ten North Frederick Street," by John O'Hara; and Winston Churchill's "History of the English Speaking Peoples."

Moving over to Ohio, Cleveland Electric Illuminating's current preferences are: "The Art of Problem Solving," by Edward Hodnett; "Effective Communications on the Job," edited by M. J. Dooher; an American Management Association publication, "Planning and Developing the Company Organization Structure"; and "The Man in the Gray Flannel Suit," by Sloan Wilson.

In Middle South Utilities, reading choice includes "Wall Street Men and Money," by M. Mayer and a couple from the best seller lists: "No Time for Sergeants," by M. Hyman; and "Stillness at Appomattox," by Bruce Catton.

"Fergus here, has a novel theory about splitting the atom!"

The straw poll showed that current best sellers are popular almost everywhere, including companies not mentioned above. Another common denominator in reading preference was for books of self-improvement, do-it-yourself subjects, and, of course, books dealing with electrical engineering.

Having completed the foregoing research, we wondered about our own organization. We found the same heavy demand for self-improvement and do-it-yourself topics. Specifically, these two titles are in big demand in the McGraw-Hill Publishing Co: "Developing Your Executive Skills," by Auren Uris; and "A Guide to Home Landscaping," by Donald J. Bushey. Spring must be here.

Your Health, REX H. WILSON, MD, Medical Director, B. F. Goodrich Co

Many a man has found fame and fortune following his physician's advice to "take it easy."

Yet too many people die from heart attacks, the result of occlusive changes, or closings, in the coronary blood vessels. These vessels supply blood to the heart and a reduction in this supply brings degenerative changes, or weaknesses in the heart's muscular wall. These changes cause the heart to function poorly, or, if extensive enough, to stop.

You may have an occlusion and not even be aware of it. Pains or gripping band-like sensations about the left side of the chest, with or without pain in the left shoulder and arm, are a warning sign of degenerative heart disease. These signals of coronary artery disease are called "angina pectoris." The occlusion, or closing, may also be the result of an embolic blood clot—that is, any foreign matter, air bubble or clot, in the blood stream.

Coronary artery disease has become the publicized 20th-century ailment. The way we eat and live are probable causes.

Consult your doctor right away if you begin to have a pain in the left chest or difficulty in breathing after exertion. Too many men around 40 years of age suffer their first symptoms while shoveling snow or doing something equally strenuous.

Don't ignore the warning symptoms. You can find out your true condition from a few laboratory tests, including an electrocardiogram.

A heart attack is not necessarily fatal or even the beginning of the end. By taking proper care of yourself you can live long and successfully.

WASHINGTON COMMENT

Early Sniping at McKay Starts

Democrat majority on House Government Operations Committee rushes report charging that McKay and his aides wanted to "cripple" federal power program

The public power attack on Senate Candidate Douglas McKay has started, eight months before the Oregon elections.

McKay announced on March 9 he would quit his post as Secretary of Interior under President Eisenhower. His opponent will be Wayne Morse, incumbent, who undoubtedly will be picked to run again by Oregon Democrats. Morse is perhaps the most outspoken public power advocate in Congress.

McKay sent his letter of resignation to the President on March 27, and Eisenhower accepted it the next day. Democrats lost no time. The House Government Operations Committee, which has conducted a months-long investigation of Interior Department power marketing practices last year, published a scathing attack on McKay and his aides under the guise of commenting on marketing regulations. Release of the report was timed to coincide with the President's acceptance of McKay's resignation.

The report charged that the actions of McKay, former Under Secretary Ralph A. Tudor, present Under Secretary Clarence Davis, and Assistant Secretary Fred G. Aandahl illustrate their desire to "cripple and thwart a sound federal power program as established by Congress."

Preparation of the adverse report was hurried. In fact, the order to get it printed seems to have gone out immediately after McKay announced on March 9 he would be a Senate candidate. The Democratic majority was in such a hurry to unleash its blast, it didn't even take the time—or risk—to permit minority members of the committee to look it over.

The minority was given one week in which to prepare its views, and these were issued separately, not as a part of the printed official committee report. The minority declared the committee report a staff effort, rather than a reflection of the views of committee members.

It is obvious there was political motivation behind issuance of the committee report. There is no doubt that it was meant to hurt McKay.

But there are two factors working in the new candidate's favor:

1. The report came out a long time before the elections, long enough probably for it to be forgotten by November.

2. McKay's policies can successfully withstand such attacks. There is ample time for an airing of the committee's charges, and the lack of proof of wrongdoing contained in the report can be brought out in a vigorous political campaign which can put the Democrats "findings" in their proper perspective.

McKay's real test may prove to be the desires of the people of Oregon: Do they, or do they not want to keep the government out of business? His opponent, Wayne Morse, has, of course, long advocated greater federal development of natural resources.

TECHNICAL NOTES

Aluminum spray coating on shot-blasted steel structural members, followed by one coat of paint, is expected to provide longer protection than the usual two coats of paint after wire brushing.

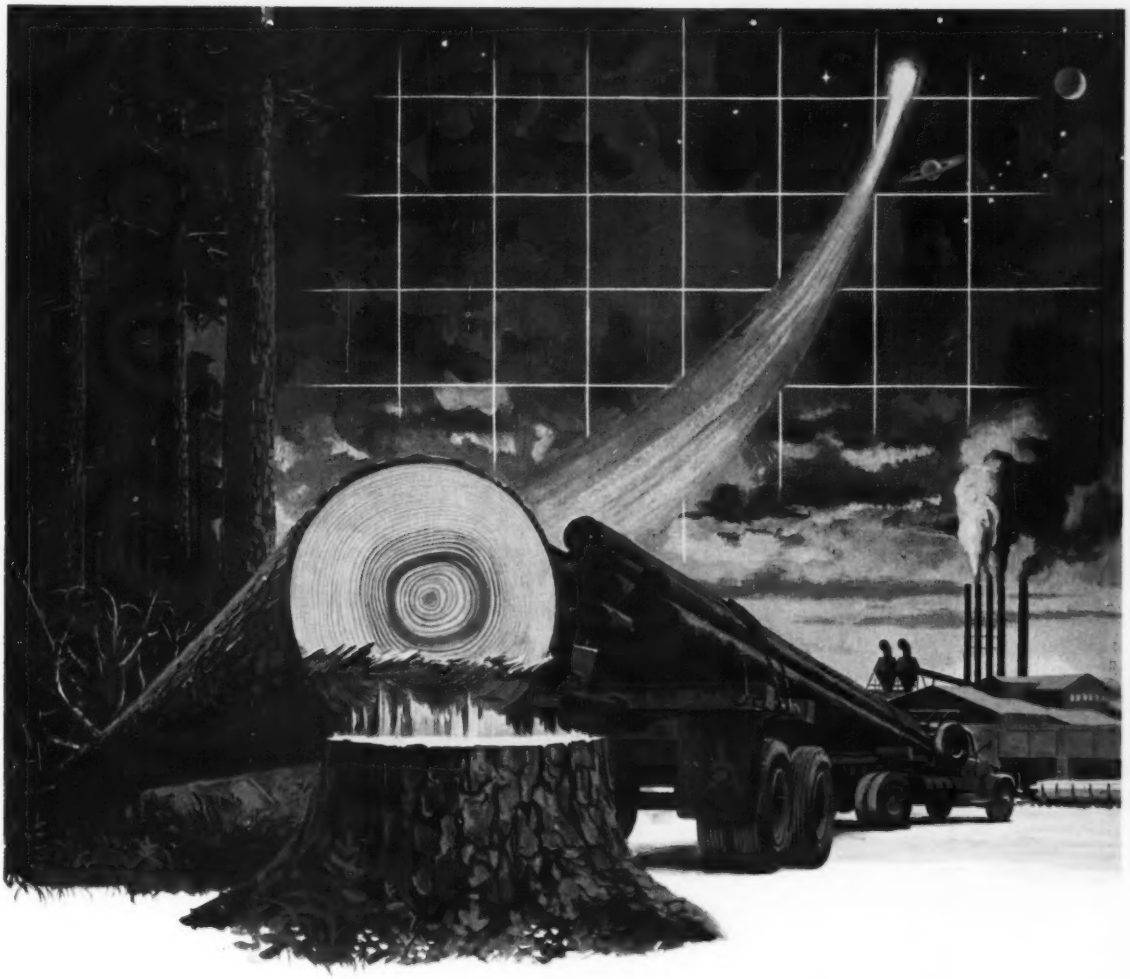
Flyash and slag from pulverized-fuel boilers, mixed with lime, shows promise as a base for paving.

Distribution transformer failures seem predictable by actuarial methods. If so, they, like humans, will survive for years with a gradual upturn in mortalities until a sharp peak occurs shortly after average life expectancy. Group replacement before this peak should preclude an epidemic of failures during a peak load period.

Pipe-line pumping costs have been cut 33% by replacing internal-combustion-driven reciprocating pumps with remote-controlled, motor-driven centrifugal units.

Aluminum windings and terminals have proved successful and economical in dry-type specialty and small distribution transformers up to 4.8 kv.

Nuclear power plant non-routine maintenance and repair is 80% on items that occur in conventional fuel plants, according to a recent review of test experience. Typical items are loose connections, manufacturer's errors, and foreign matter in mechanical systems.



a major advance in pressure-treated pole production

by OLIN MATHIESON

Keyed to the soaring growth of America's public utilities, Olin Mathieson has now expanded its FROST pressure-treated pole operation to major proportions by the purchase of additional plant facilities.

The FROST operation of Olin Mathieson is managed as a modern, fully-integrated program — from vast forest reserves to pressure-treating facilities. Olin Mathieson's inflexibly high standards assure unexcelled quality in product and service.

Planning-in-depth, constant-cycle harvesting and high operating efficiency enable FROST to offer a complete selection of pressure-treated poles for prompt shipment to any destination. FROST efficiency stands ready to eliminate your planning and inventory problems.

Frost

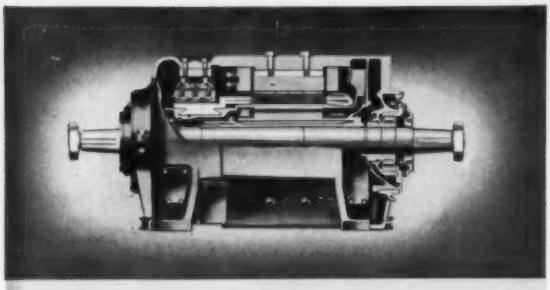
FOREST PRODUCTS DIVISION

OLIN MATHIESON

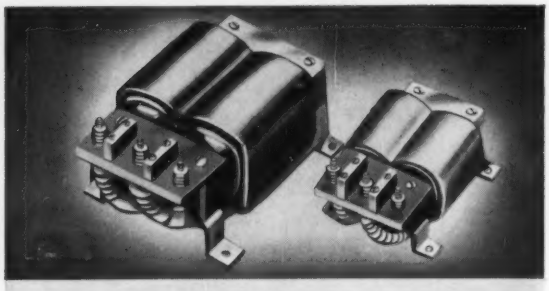
CHEMICAL CORPORATION

SHREVEPORT, LOUISIANA

How you profit by using



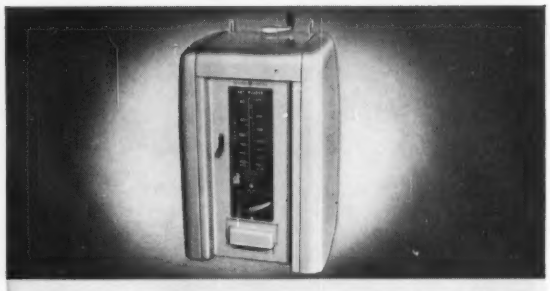
G-E CLASS H INSULATION protects all coils in this rugged mill motor: silicone-treated mica mat on armature, commutating and exciting field coils; silicone varnish impregnates coils.



DRASTIC REDUCTIONS in size and weight are possible with G-E silicones. The tiny autotransformer (right) has been "shrunk" to half former size—yet carries more power.

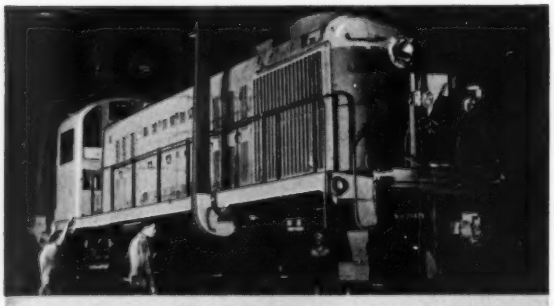
G-E silicone insulation

NEARLY TWICE THE CURRENT—with no increase in size—is realized in this generator lead cable built with glass cloth coated with G.E.'s SE-100 silicone rubber compound.



LIGHTER, MORE COMPACT DESIGN, plus a new margin of safety through high overload protection, is achieved in this welding transformer made with G-E heat-resistant silicones.

in applications like these



LONGER LIFE for traction-motors on diesel-electric locomotives results from G-E Class H silicone insulation which cuts maintenance costs under severe operating conditions.

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GENERAL ELECTRIC COMPANY
Section 62-1C
WATERFORD, NEW YORK

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Export Distributor—INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

THE NATIONAL TELEPHONE SUPPLY COMPANY

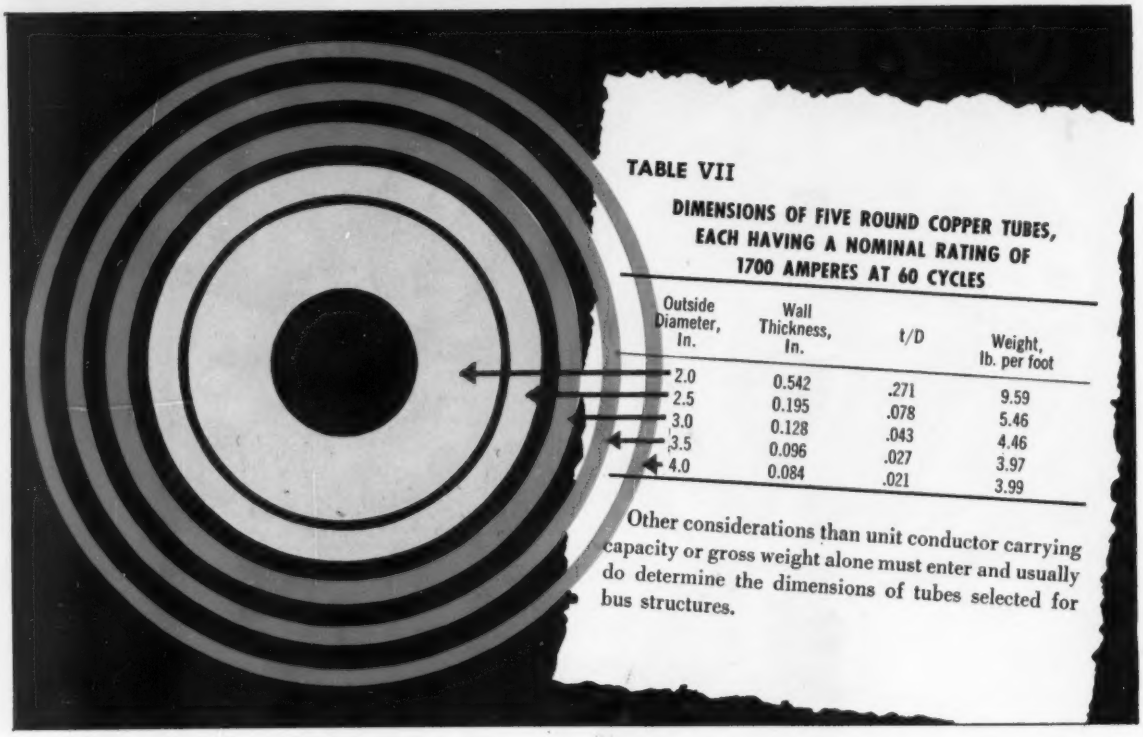


TABLE VII

DIMENSIONS OF FIVE ROUND COPPER TUBES, EACH HAVING A NOMINAL RATING OF 1700 AMPERES AT 60 CYCLES

Outside Diameter, In.	Wall Thickness, In.	t/D	Weight, lb. per foot
2.0	0.542	.271	9.59
2.5	0.195	.078	5.46
3.0	0.128	.043	4.46
3.5	0.096	.027	3.97
4.0	0.084	.021	3.99

Other considerations than unit conductor carrying capacity or gross weight alone must enter and usually do determine the dimensions of tubes selected for bus structures.

Reducing Bus Costs with Thin-Wall Tubes

Where mechanical requirements permit, bus costs can be cut through the use of tubular bus conductors with low wall-thickness-to-diameter ratios.

The chart above shows how the weight of metal purchased goes down as the t/D goes down for five round copper tubes of the same nominal current-carrying capacity.

What is true of round tubes is also true of other tubular bus shapes—low wall thickness giving decided electrical advantages.

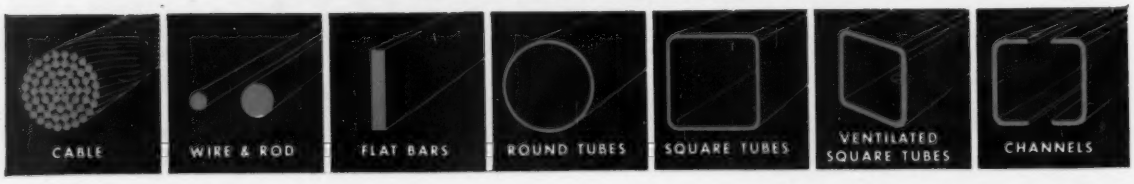
Round tubes in the standard pipe dimension, and thin-wall sizes also offer other advantages. You can utilize the great variety of stock sizes of supports, connectors, clamps, and other hardware in dealers' stocks.

For more complete information on the use of thin-wall tubes see the brand-new Fifth Edition of The American Brass Company's publication, "Anaconda Copper for Electrical Conductors." This 62-page booklet has a wealth of general information on the properties of electric conductors – plus convenient tables giving the electrical and mechanical properties of copper bus conductors for all the most commonly used sizes of the popular shapes. Much of the material has not heretofore been published.

TECHNICAL SERVICE. The services of Anaconda specialists are available to help you in the solution of special problems involving the use of ANACONDA Bus Conductors. For such help—or for a copy of "Anaconda Copper for Electrical Conductors"—see your nearby Anaconda representative. Or write: The American Brass Company, Waterbury 20, Conn. 5899

ANACONDA® COPPER CONDUCTORS

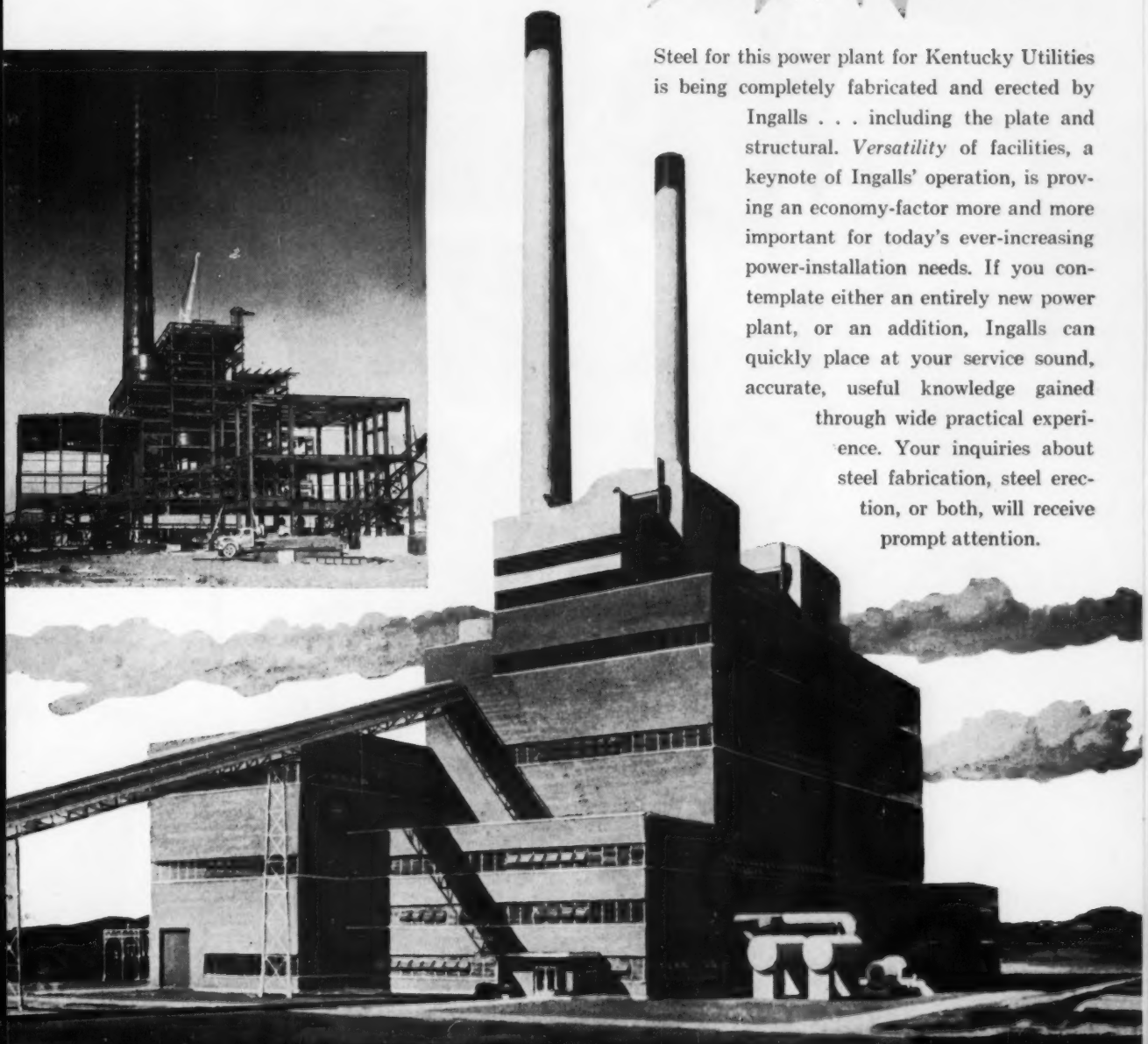
THERE'S AN ANACONDA ELECTRICAL CONDUCTOR FOR EVERY NEED



COMPLETE

FROM THE GROUND UP

Steel for this power plant for Kentucky Utilities is being completely fabricated and erected by Ingalls . . . including the plate and structural. *Versatility* of facilities, a keynote of Ingalls' operation, is proving an economy-factor more and more important for today's ever-increasing power-installation needs. If you contemplate either an entirely new power plant, or an addition, Ingalls can quickly place at your service sound, accurate, useful knowledge gained through wide practical experience. Your inquiries about steel fabrication, steel erection, or both, will receive prompt attention.



FABRICATING STEEL IS OUR BUSINESS

THE INGALLS **IRON WORKS COMPANY**

BIRMINGHAM, ALABAMA

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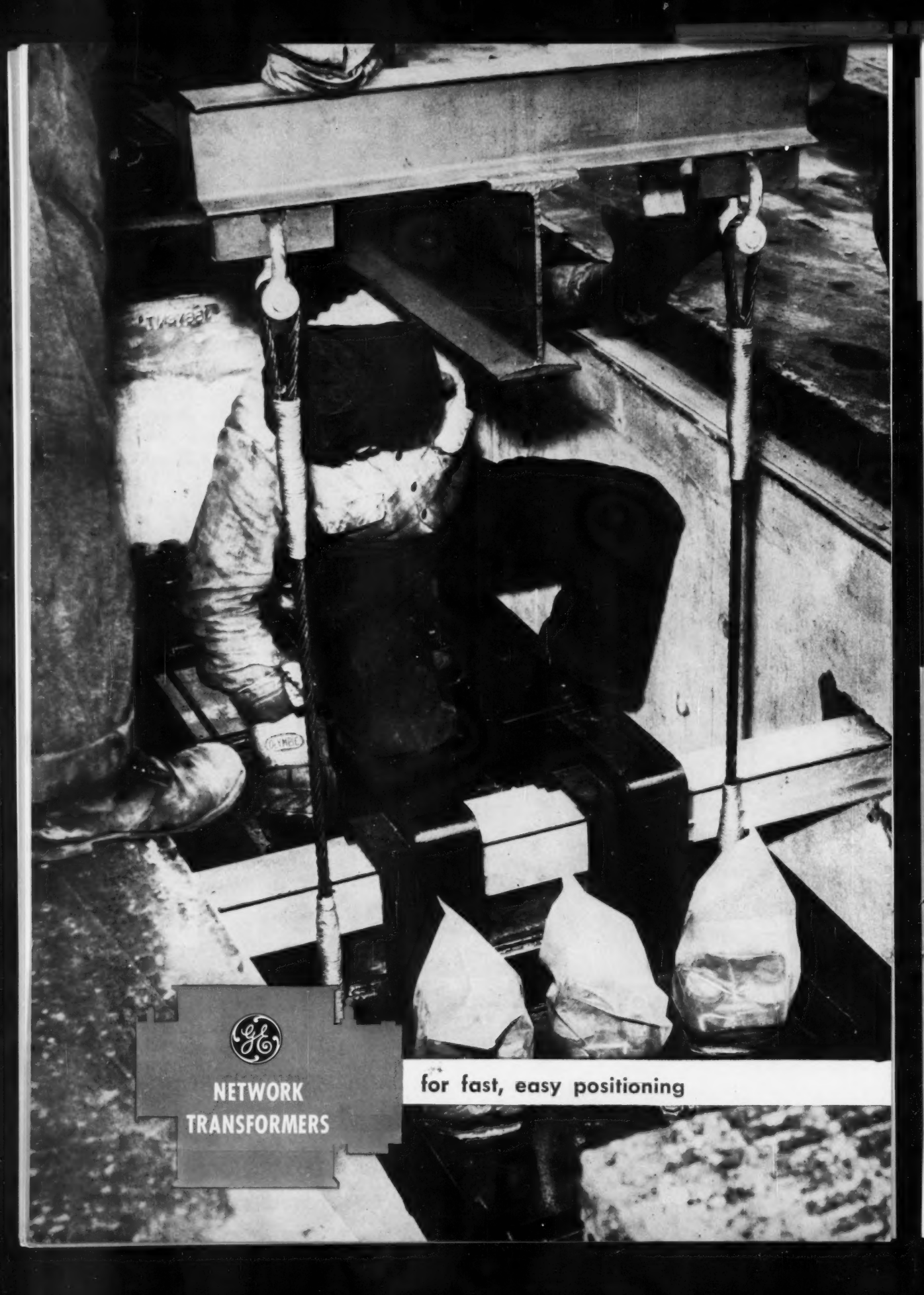

NETWORK
TRANSFORMERS
for fast, easy positioning

NEW SUSPENSION MOUNTING

reduces positioning time for G-E network transformers to minutes instead of hours

A new design idea—suspension mounting—now greatly simplifies installation and maintenance of network transformers.

Developed jointly by General Electric and Consolidated Edison Company of New York, suspension mounting enables you to position a transformer in a fraction of the time formerly required. Vault floors need not be level. Furthermore, your construction men can quickly level the transformer since it is much easier to shim an I-beam cross bar before hanging a transformer from it than to shim a transformer after placing it on a vault floor. The Consolidated Edison men placed their first unit in position and levelled it in less than 10 minutes!

MAINTENANCE IS SIMPLIFIED, TOO

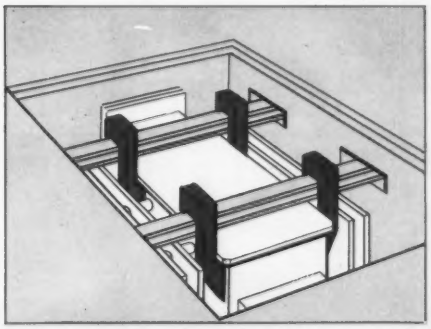
With suspension mounting, the transformer is 8 to 10 inches above the floor of the vault, away from corrosive elements such as sewage, dirt, and chemicals, which collect in most vaults. This retards corrosion of the tank, making it necessary to clean the vault far less frequently than when the transformer is set on the floor. When cleaning becomes necessary, it's easy to flush out the vault because there is clear passage under the transformer.

It's also easy to clean and repaint the transformer. Radiators are of the panel type, with large flat surfaces easily accessible from the top or ends. Just use a long-handled brush or nozzle.

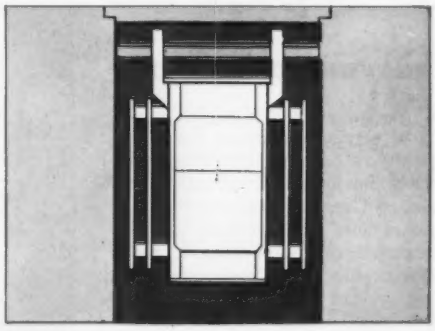
Maintenance is simplified in other ways, too. You can remove bushings, for example, from the outside of the tank. There are no large gaskets to replace. Accessories are located on the high-voltage end of the transformer where you can easily reach them. It's easy to inspect the network protector because it slides out on rails.

HELP FOR YOU

For help in solving your network problems and for complete information on the advantages of suspension-mounted G-E network transformers, see your local G-E sales representative. General Electric, Schenectady 5, N. Y. 435-6



SUSPENSION MOUNTING. Two sturdy hooks rest on I-beams installed above transformer. Each beam rests on bearing plate in side-wall recess.



PLENTY OF SPACE under transformer keeps it above chemicals and debris, retarding corrosion and permitting fast and easy cleaning of vault.

Progress Is Our Most Important Product

GENERAL ELECTRIC

ADVERTISEMENT

Design Factors in Telemetering Systems

Four important points to consider in planning for remote measurement or recording

A BRISTOL APPLICATION NOTE

Telemetering systems provide a proven way to keep tabs on a remotely located process, pipe line, service or utility. In fact, any time remote indication recording, or control is required, telemetering can serve your needs.

Here are the four conditions which must be considered in selecting the best telemetering system for any installation.

1. VARIABLES

Most industrial variables can now be measured, computed, and converted into a form that can be transmitted electrically. Their number and variety influence circuit complexity and the appearance of the receiving panel. Some variables now being successfully telemetered include:

Pressure • Current and voltage • Temperature • Flow • Electrical power • Wind velocity • Liquid level • Motion • BTU's • pH Horsepower • Speed

2. FREQUENCY OF READING

While the majority of telemeter systems in service today are the point-to-point continuous recording type, complex networks and interrelated variables are making sophisticated approaches more and more necessary. The problem usually boils down to these questions: how often is measurement necessary, and what is the least costly way to install and run the system?

Five types of possible hook-ups are:

Continuous recording—where variables are critical and need constant watch.

Intermittent indicating—where variables need only be checked at intervals.

Continuous-Intermittent—where it is possible to separate more critical variables for constant and intermittent telemetering.

Grouped-Multiplex—where several measurements can be transmitted as a group over a single circuit into a "multiplexed" receiver.

Successive-Multiplex—where measuring points over a large area can be "multiplexed" at intermediate locations, then herded to the panel.

3. TERRAIN

The type of interconnecting circuit between the measuring transmitters and central panel usually depends on the terrain: its topography, weather, and degree of settlement. Hence, signals may be carried by one, or by combinations, of the basic transmission media:

Radio—various types of radio can be used to take signals over mountains, deserts, and seas.

Wire—strung wire or leased lines can cover plant, urban, and rural areas.

4. INSTRUMENTATION

Bristol Metameter® Telemeters are eminently adapted to any of the conditions of measurement frequency, variables, or terrain likely to be encountered in telemetering. Transmission can be provided over telephone circuits, carrier current, radio—including microwave, VHF and UHF—and private wires, multiplexing and selective calling. Under all sorts of conditions, thousands of installations, ranging from just a few to hundreds of instruments each, have proven the dependability and reliability of Bristol Telemeters—pulse width (or duration), differential transformer, and voltage types, as well as pneumatic systems.

For more information on how Bristol Telemeters can benefit *you*, write THE BRISTOL COMPANY, 116 Bristol Road, Waterbury 20, Conn. 5.44

TYPICAL RECEIVING CENTER in multiplexed telemetering system.

BRISTOL *POINTS THE WAY IN HUMAN-ENGINEERED INSTRUMENTATION*

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

ALUMINUM-SHEATHED CABLES

Pioneered in the U. S. by

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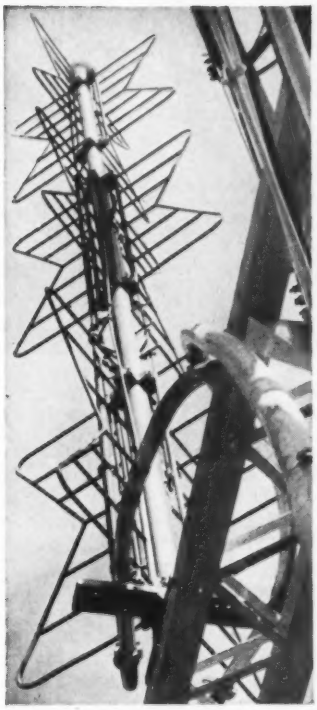
Over 600 Miles of Phelps Dodge Aluminum-Sheathed Cable Have Been Put into Service Since 1952!



Phelps Dodge aluminum-sheathed *communication* cables have been installed on a number of major commercial and national defense projects. In addition, the majority of the VHF-TV commercial transmitting antennas in the U. S. are now equipped with these cables.

Phelps Dodge aluminum-sheathed *power* cables have now been installed on the lines of several of the country's leading utilities, both aerially and underground.

The introduction of aluminum sheathing has opened up great advances in the cable field. Aluminum's lighter weight (permitting longer cable spans) and greater tensile strength are admirably adapted to cable applications of various kinds. Cables can be provided with polyethylene jacket for corrosion protection.

Phelps Dodge's pioneering background, manufacturing skill and thorough engineering "know-how"—the result of four years of experience in this highly specialized field—are unsurpassed.

We welcome your inquiries. Write Dept. ED

PHELPS DODGE COPPER PRODUCTS CORPORATION

300 PARK AVENUE, NEW YORK 22, N. Y.

THE ORIENT'S FIRST ARCH DAM

Now spanning the gorge of the Mimi River in mountainous southern Japan is the Kamishiiba Arch Dam, highest dam in that country and the first of its type in the Orient.

This recently completed project rises 372 feet high, is 1200 feet across. This structure, unique in Japanese dam building, is designed to resist the heavy earthquakes prevalent in the region. The dam will impound seasonal flood waters in one of Japan's largest power storage reservoirs for use by six hydroelectric projects downstream.

Ebasco's work on Kamishiiba for the Kyushu Electric Power Company included preliminary study, supervision of design and construction, and the training of Japanese personnel.

Successful completion of the project is the highlight of Ebasco's five-year association with the Japanese power industry.

Write for the "Inside Story of Outside Help." Address Ebasco Services Incorporated, Dept. M, Two Rector Street, N. Y. 6, N. Y.

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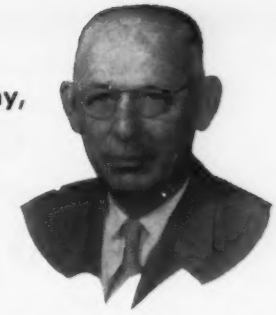
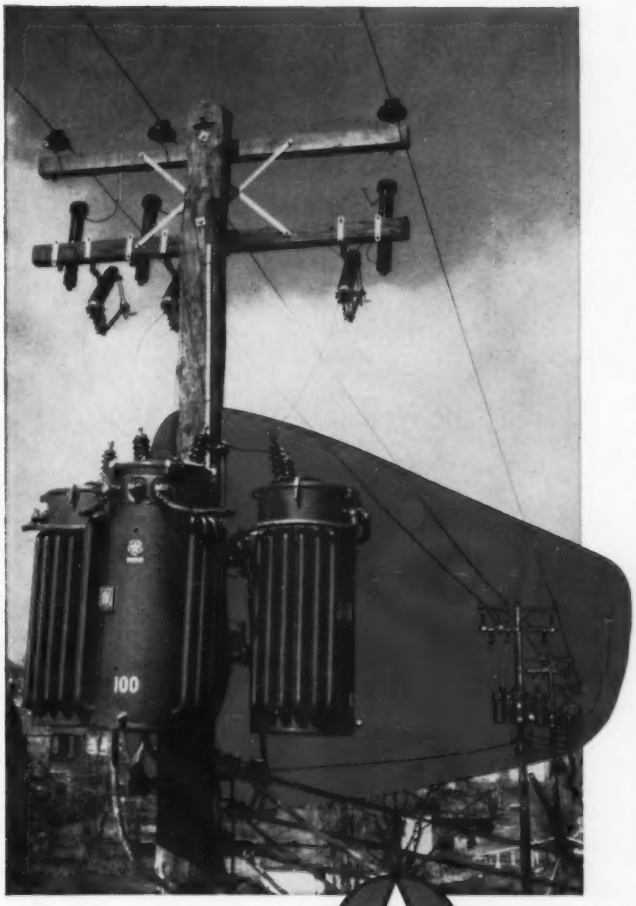
J. A. Siegfried, DISTRIBUTION ENGINEER
Pennsylvania Power & Light Company,



Tells HOW... and WHY... POLE STAR "CLUSTERS" ARE USED TO SUPPLY 3 PHASE POWER TO SHOPPING CENTER



Because of the compact Pole Star design, even 100 kva units can be cluster-mounted, as shown in this view of the installation described in Mr. Siegfried's letter. The Pole Star cluster is supplying three phase power to a shopping center.

In a letter to Ray Swoish, vice president of Pennsylvania Transformer Company, Mr. Siegfried says, in part:

"You will probably remember that we talked about mounting large size distribution transformers on a cluster mounting arrangement last year. Since then, we have installed quite a number of these jobs and have found that they do a quick and neat job.

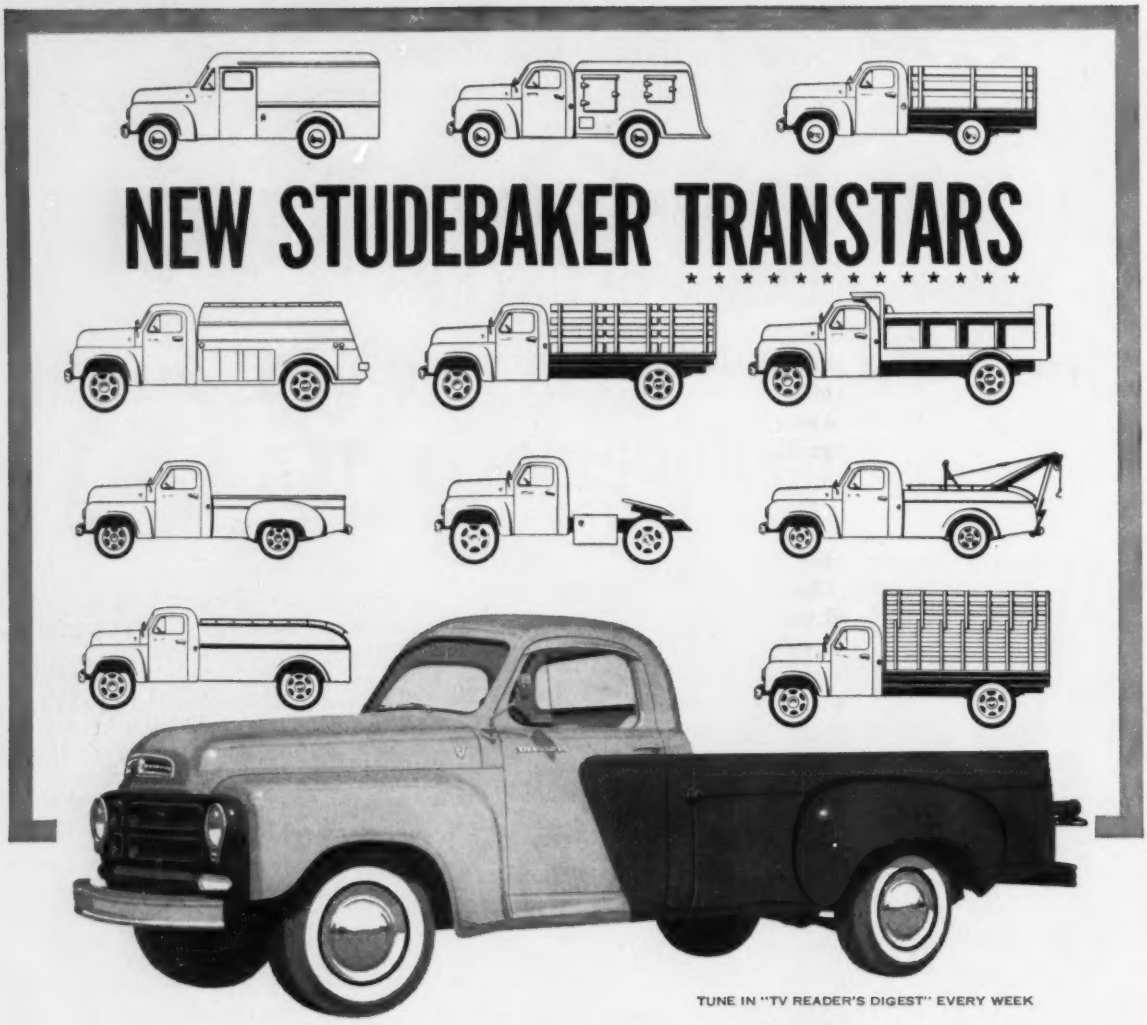
"I am enclosing a photograph of a rather unusual installation which we erected in order to supply electric service to a shopping center in the town of Lemoyne across the river from Harrisburg, Pa. In order to avoid the installation of extremely heavy secondary wires, we made an installation of seven 3 phase banks on adjacent poles. The picture shows five banks; however, there are actually seven banks in a continuous line skipping only one pole. Each of these banks supplies two or three customers. These customers are stores and various other commercial enterprises which go to make up the shopping center.

"You will no doubt be pleased to see three 100 kva Pennsylvania Transformers mounted on a single pole shown in the foreground of this picture. There are five other Pennsylvania installations and one bank of (a competitive make)."

Pole Star Distribution Transformers—featuring the patented lap-on-top core — are available in all single phase sizes from 3 through 500 kva, 480 through 67,000 volts. The Pole Star line includes a 167 kva "Featherweight" with standard EEI-NEMA mounting provisions, and Protected Pole Stars (Type CSP) up through 100 kva.

POLE STAR

Pennsylvania Transformer Company
A McGraw Electric Company Division
CANONSBURG, PENNSYLVANIA • *Greater Pittsburgh District*



NEW STUDEBAKER TRANSTARS

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

TUNE IN "TV READER'S DIGEST" EVERY WEEK

America's easiest riding, hardest working truck—and here's why!

Exclusive Twin-Traction Differential*—new pull-away power where other trucks bog down.

Shortest stroke V8—bar none! High torque delivers greater economy. Thrifty 6's, too!

High payload chassis construction—extra-strong frame for long truck life.

Widest clear floor in pick-ups—exclusive double-walled construction with no lost wheel well space.

Cross-link, variable-ratio steering—steadier, easier handling on turns and straightaways.

Two-stage underslung rear springs—smoother going with heavy loads; freer action "riding light."

Improved Studebaker economy—cut your gas-oil and maintenance costs through the years.

Priced with the lowest. Studebaker Transtars are priced for today's market; excel in value!

**available on ½-ton models at extra cost.*

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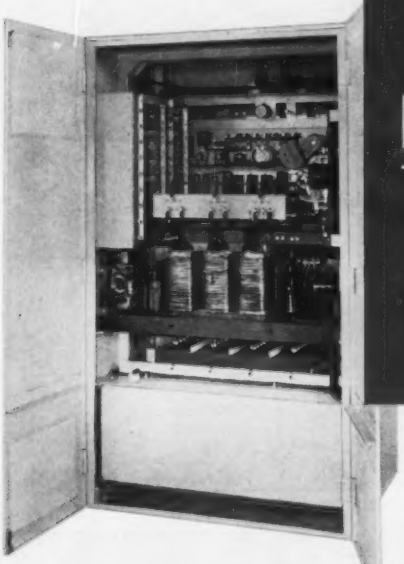
star performers with saving ways

STUDEBAKER DIVISION OF STUDEBAKER-PACKARD CORPORATION—WHERE PRIDE OF WORKMANSHIP STILL COMES FIRST!

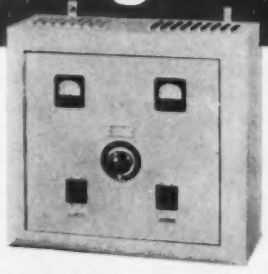
standby power...just sleeping...not dead

Yes, it's mighty quiet in most battery rooms, but if service continuity is to be maintained, every cell must be ready *at all times* to spring to immediate action. For dependable switchgear operation . . . and for railway signalling, alarms, communication equipment and the other applications where *positive performance* of storage batteries is vital . . . more and more utilities and industries are finding that INET-Palmer *Regulated* Battery Chargers are the best form of insurance. And, one of the least expensive. Completely unattended, they guard batteries against sulfation and discharge . . . make sure *24 hours a day* that standby power, on those rare occasions when it's needed, is always ready.



...thanks to INET-Palmer

regulated battery chargers



6 reasons why INET-Palmer regulated chargers are your BEST BUY...

COMPLETELY AUTOMATIC . . . operates unattended; no operator required.

DEPENDABLE . . . no moving parts or vacuum tubes used in circuits.

STABLE . . . less than ±1% variation from no-load to full-load despite ±10% *simultaneous* input variation.

EASY INSTALLATION . . . floor, wall, or panel models available.

WIDE RATING RANGE . . . 3 to 60 cells in ratings to 50 KW.

LOW OPERATING COST . . . nothing to wear out, nothing to maintain.

Send today for Bulletin T-1100 containing complete specifications.

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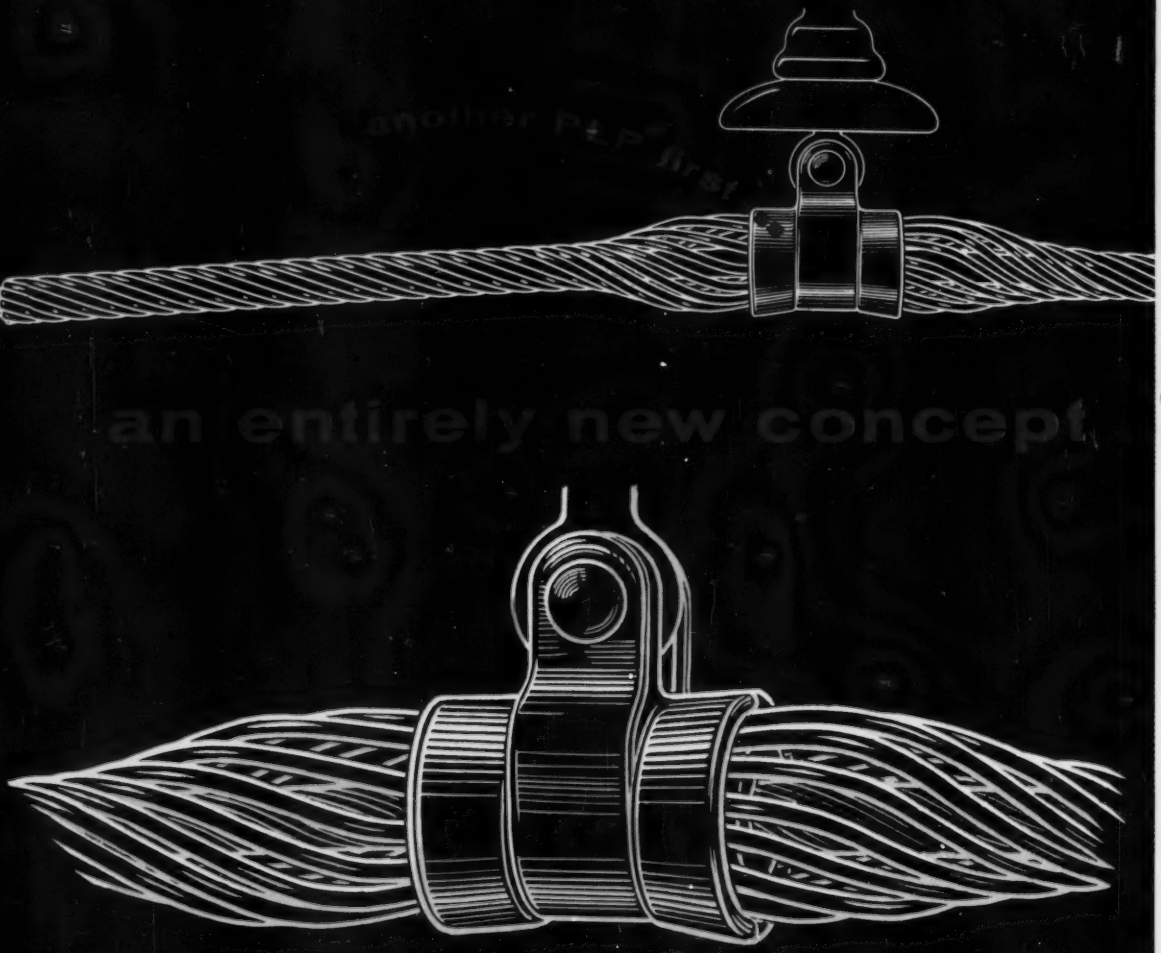
another first

an entirely new concept



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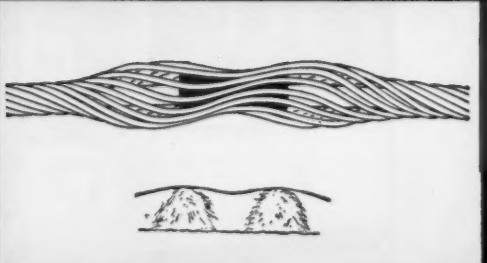
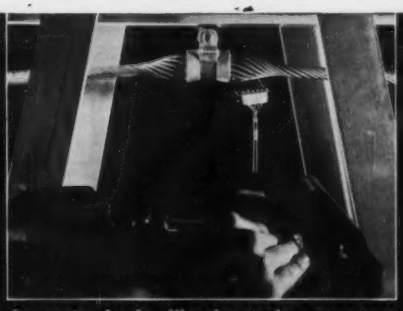


CONDUCTOR FLOATS freely through "clamping" region. A protective "cage" of Armor Rods applied over a cushioning neoprene sleeve eliminates clamping stress.



Accurate checks, like the strain gauge test shown here, record the performance of the ARMOR-GRIP SUSPENSION under vibration. Results prove that vibration stress in all conductor elements is reduced up to 50%.

In the PLP Laboratory, the ARMOR-GRIP SUSPENSION is proven under severe vibration conditions.

in suspension design

After five years of intensive laboratory research and field experience, Preformed Line Products Company announces the ARMOR-GRIP SUSPENSION. This is not just a modification of the conventional clamp—in fact, in a sense it is not a "clamp" at all. The ARMOR-GRIP SUSPENSION is a "floating suspension"—the conductor is cradled in neoprene and firmly gripped only by the custom-designed Preformed Armor Rods which distribute their pressure over a relatively large area. An ingenious relation between rods and housing prevents the suspension assembly from slipping longitudinally. The expanded configuration of the PLP rods also adds rigidity to the conductor while slight vertical resilience of the conductor mounting eliminates a steep stress gradient.

THE ARMOR-GRIP SUSPENSION ELIMINATES CONCENTRATED CLAMPING STRESSES.

In severe accelerated vibration tests, conductor mounted in the PLP ARMOR-GRIP SUSPENSION outlasts conventional clamp assemblies many times—in fact, no conductor failures have ever occurred under the ARMOR-GRIP SUSPENSIONS in these tests. Thousands of ARMOR-GRIP SUSPENSIONS have been installed during the past four years—with NO reported case of unsatisfactory performance.

Yet with all these functional advantages, the ARMOR-GRIP SUSPENSION is very easy to install. Simplicity of design has eliminated many parts—there are less than one-half the number contained in a conventional clamp assembly. Only one nut to tighten.

The ARMOR-GRIP is immediately available in conductor sizes in the ranges of 336,400 cm, 477,000 cm, 795,000 cm, 954,000 cm ACSR and All-Aluminum. Other sizes will soon be available and can be produced on request.

Made in accordance with or for use under one or more of the following U. S. Patents: 2,722,393; 2,275,019; 2,587,521; 2,609,653; 2,691,865; other patents pending.

EXPANDING THE PREFORMED ARMOR RODS in the support region greatly increases the rigidity of the conductor just as struts in a frame increase rigidity.

WITHSTANDS SLIPPING UNDER UNBALANCED SPAN LOADS. Conical shaped armor rod "saddle" seated in contoured casting prevents conductor shifting in assembly. Only cushioning neoprene contacts conductor at support center. Conductor is gripped only by PLP Preformed Rods which distribute pressures over large conductor areas.

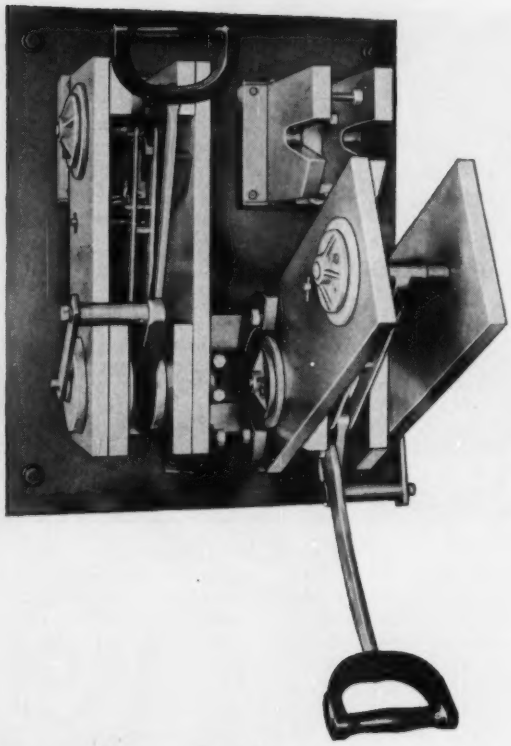
CORONA AND HEAT LOSSES. The ARMOR-GRIP is symmetrically designed and radiused—with no protuberances—thus eliminating a source of corona emission and radio influence. The metal componenrs are all-aluminum alloy—there are no magnetic heat losses.

PREFORMED LINE PRODUCTS COMPANY

5349 ST. CLAIR AVENUE • CLEVELAND 3, OHIO

TELEPHONE: CLEVELAND EXPRESS 1-3571

For shock resistant, dielectrically-strong mounting panels...



Ebonized Asbestos forms a sturdy mounting panel for this 10,000 ampere, 110-volt disconnecting switch made by Pringle Electrical Manufacturing Company, Philadelphia.

K&M Ebonized Asbestos

the ideal electrical insulating material

Use K&M Ebonized Asbestos for switchboards, bus bar supports, cabinets, compartment linings, bench boards, testing tables—wherever you need rugged insulating material for mounting electrical apparatus.

It has exceptionally high dielectric strength. Its high mechanical strength provides stubborn resistance to vibration, shock, temperature changes—and makes components stay put. Ebonized Asbestos is relatively light in weight, uniform in density, easy to cut and drill.

These specifications tell the story

Density	120 lbs. per cubic ft., min.
Safe working temperature	300° F.
Tensile strength	3000 psi, min.
Compression strength	11,000 psi, min.
Modulus of rupture in flexure	4000 psi, min.
Moisture absorption	1.0% max.
Dielectric strength (Tested perpendicular to thickness per ASTM D149-44 [short-time test].)	Ranges from 50 volts per mil., min. for thicknesses of ½" and less to 25 volts per mil. for thicknesses over 1¾ to 2".

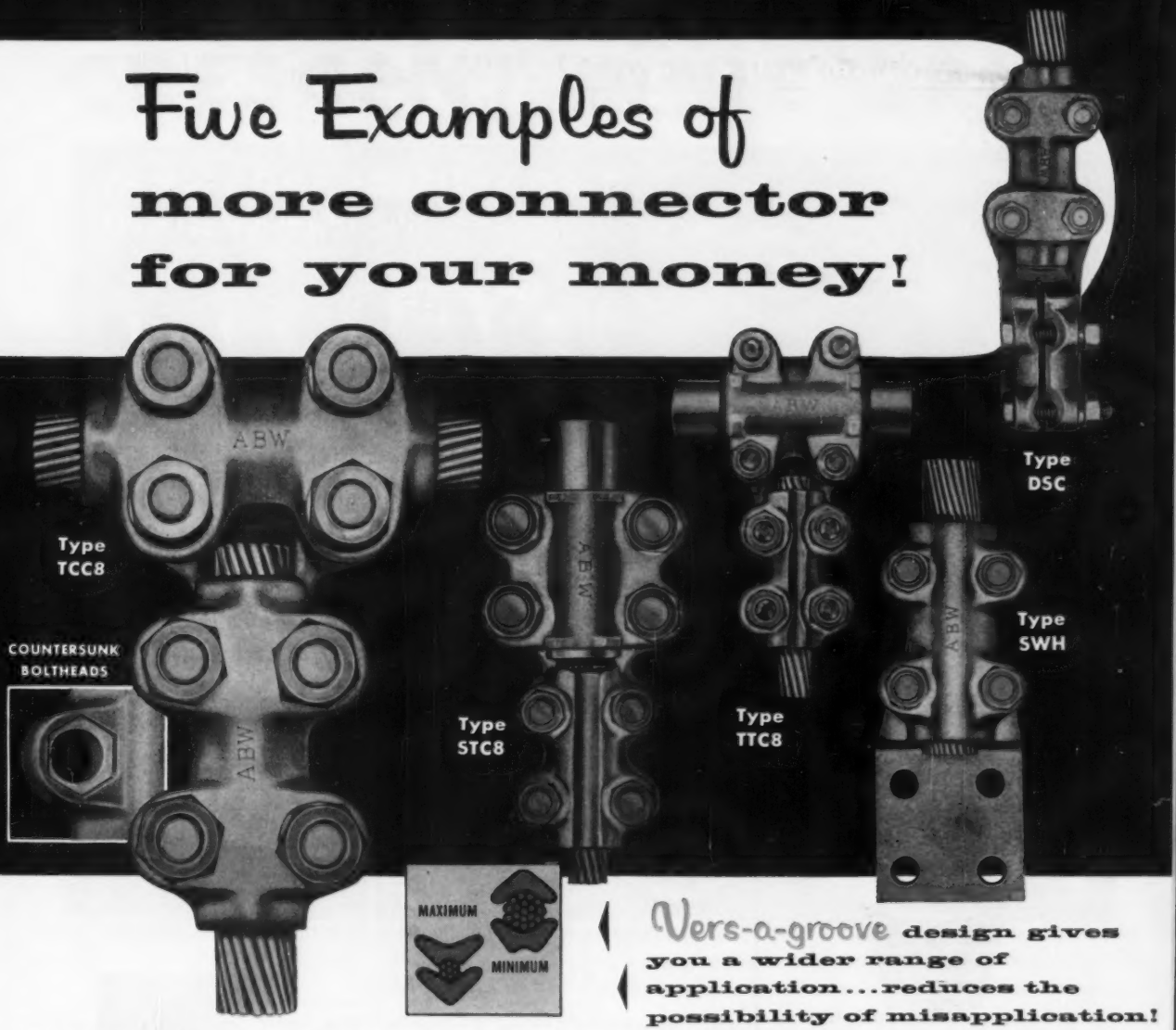
Send for data. We'll gladly send complete information on Ebonized Asbestos and other outstanding K&M insulating materials, including Monobestos, asbestos cloth, tapes and tubing for electrical equipment. Write for details.

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

K&M best in asbestos®

In Canada: Atlas Asbestos Company, Limited; Montreal, Toronto, Winnipeg and Vancouver

Five Examples of more connector for your money!



Vers-a-groove design gives you a wider range of application... reduces the possibility of misapplication!

The 9 *stand-out features* of these Anderson Substation Connectors cannot be duplicated by any other connector line available. Look over these features carefully... *several manufacturers may claim some of them, but no connector line has them all!*

1. Two complete pairs of clamping bolts on both main and tap provide *extra insurance* against connector failure. *Most other designs have only six bolts.*
2. Higher clamping pressures with greater contact lengths *than in other standard connectors.*
3. Completely independent (3-piece) clamping on main and tap. Connection can be removed on one side without disturbing contacts on the other. *Most other connectors are two-piece.*
4. Conductor range practically eliminates mis-application and resulting connector "burn-downs". *Limited or no range of other connectors invite mis-application trouble.*
5. Wider conductor ranges permit considerable reduction in overall number of connectors which must be carried in inventory. *Two and three times greater inventory is required with other connectors.*
6. More connector for the money! More metal... 8 bolts instead of the ordinary 6 bolts!
7. One of the greatest advantages of these Anderson Vers-a-groove Tee Connectors is *ease of installation.* The 3-piece design, with independent clamping on main and tap, means that tap conductors may be bolted in on the ground and passed up to install over the bus runs. *Ordinary 6-bolt, 2-piece connectors much more cumbersome and difficult to handle.*
8. Cast surfaces which are inherently rough and tough mean positive electrical contacts. This feature plus the greater clamping strength of these connectors is *a distinct advantage in overall efficiency.*
9. The design of these connectors, by Anderson, has proved itself over more than 27 years of service under all conditions in all parts of the country. *Once used... tried and proved... no customer has ever switched back to an ordinary connector.*

For more complete information, including engineering and design data, performance characteristics and other particulars, consult your nearest Anderson Representative, or write to our home office.

Aluminum & Bronze **POWER CONNECTORS • CLAMPS • FITTINGS • ACCESSORIES for SUBSTATION • TRANSMISSION • DISTRIBUTION**

ANDERSON BRASS WORKS, INC.

P. O. DRAWER 2151 • BIRMINGHAM 1, ALABAMA

an important new "PLUS FACTOR" of the Motorola Twin-V Radiophone

MOBILE

TRANSISTORIZED DYNAMIC MICROPHONE

Unprecedented voice clarity for mobile radio transmission

- true moving coil dynamic characteristics
- transistor preamplifier built-in
- printed circuit
- all-metal housing
- retains popular size and shape
- superior voice reproduction
- unexcelled reliability.

Twin-V

The new transistorized dynamic microphone, or the dual purpose dynamic "Speaker-Mike," is *optionally* available with Motorola's "TWIN-V" Radiophone—the world's finest FM 2-way mobile radio unit . . . incorporating many *exclusive* features, including universal 6/12 volt operation, Sensicon receiver, Permakay Filter, and Instantaneous Deviation Control.

Motorola's new transistorized dynamic microphone provides *mobile* transmission quality comparable to that of the base station. Unexcelled voice clarity, crispness, and intelligibility are yours in this newest Motorola *first*.

Also available as *"SPEAKER-MIKE"*

The new microphone can be furnished as a dual-purpose "Speaker-Mike" which functions as a full output communications-type *loudspeaker*, as well as a dynamic microphone. It can be conveniently mounted, or held near the operator's ear to overcome high ambient noise levels.

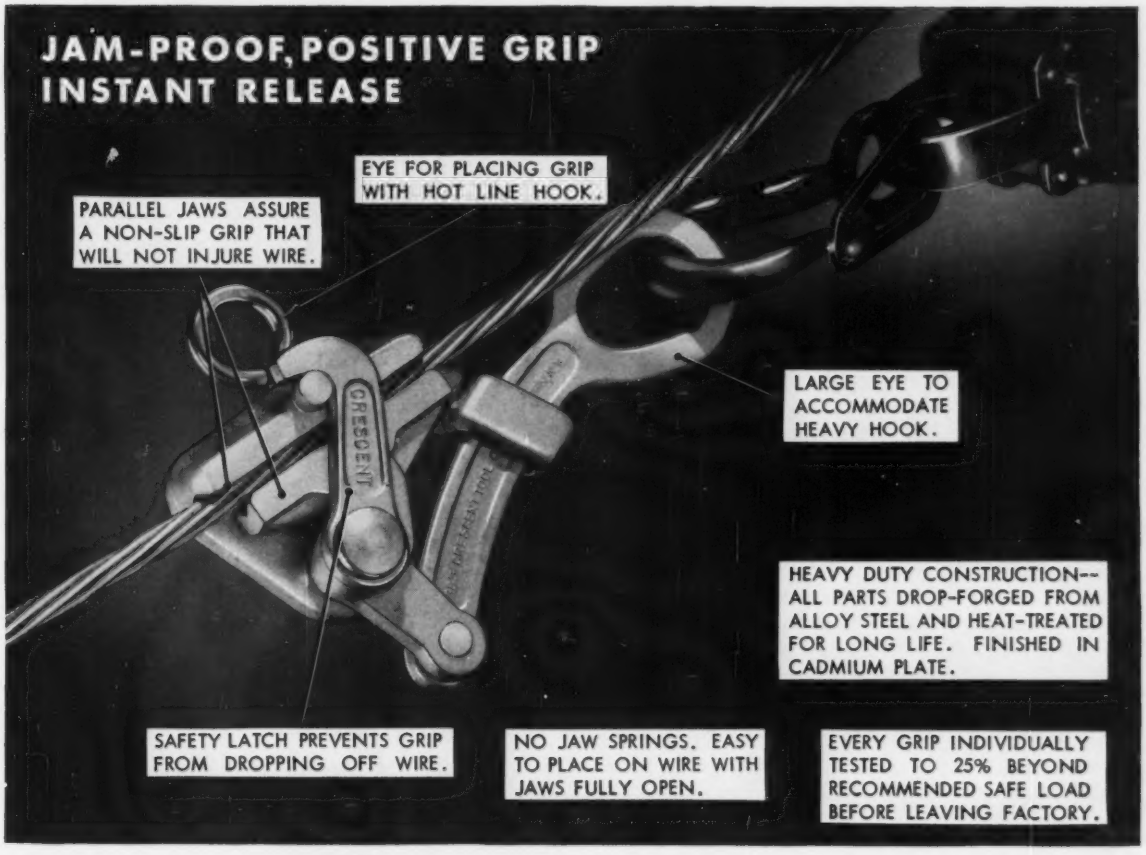
You can have either of these outstanding microphones as replacement items, or as *optional* equipment with new Motorola "TWIN-V" Radiophones. The transistorized, dynamic microphone, with its *popular palm size*, is directly interchangeable with Motorola carbon models now in use. The "Speaker-Mike" version requires a simple modification kit for replacement use in existing equipment.

Immediately available. Write, phone or wire today, or contact your local Motorola Radio Communications Engineer.

MOTOROLA COMMUNICATIONS & ELECTRONICS, INC.

A SUBSIDIARY OF MOTOROLA, INC., 4501 AUGUSTA BOULEVARD, CHICAGO 51, ILLINOIS

CRESCENT WIRE GRIPS


JAM-PROOF, POSITIVE GRIP
INSTANT RELEASE
EYE FOR PLACING GRIP WITH HOT LINE HOOK.
PARALLEL JAWS ASSURE A NON-SLIP GRIP THAT WILL NOT INJURE WIRE.
LARGE EYE TO ACCOMMODATE HEAVY HOOK.
HEAVY DUTY CONSTRUCTION-- ALL PARTS DROP-FORGED FROM ALLOY STEEL AND HEAT-TREATED FOR LONG LIFE. FINISHED IN CADMIUM PLATE.
SAFETY LATCH PREVENTS GRIP FROM DROPPING OFF WIRE.
NO JAW SPRINGS. EASY TO PLACE ON WIRE WITH JAWS FULLY OPEN.
EVERY GRIP INDIVIDUALLY TESTED TO 25% BEYOND RECOMMENDED SAFE LOAD BEFORE LEAVING FACTORY.
CRESCENT

SPECIFICATIONS

Number	*Maximum Capacity*	*Minimum Capacity*	*Safe Load*	*Eye Opening*	*Weight*
383 —Serrated Jaws	5/16 (.3125)" 8 mm.	—5/32 (.156)" 4 mm.	5,000 lbs. (2200 KG)	1-1/8" x 1-11/16"	1-3/4 lbs.
383-2—Same, except with smooth jaws for aluminum wire.					
384 —Serrated Jaws	1/2 (.500)" 12.2 mm.	—1/4 (.250)" 6.5 mm.	7,500 lbs. (3400 KG)	1-1/4" x 1-3/4"	3-5/16 lbs.
384-2—Same, except with smooth jaws for aluminum wire.					
385 —Serrated Jaws	3/4 (.750)" 19 mm.	—3/8 (.375)" 9.5 mm.	10,000 lbs. (4500 KG)	1-1/4" x 1-3/4"	4-7/8 lbs.
385-2—Same, except with smooth jaws for aluminum wire.					
386 —Serrated Jaws	1-1/16 (1.0625)" 27 mm.	—9/16 (.5625)" 14.5 mm.	12,500 lbs. (5600 KG)	1-5/8" x 2-3/8"	9 lbs.
386-2—Same, except with smooth jaws for aluminum wire.					

For bare and insulated wire, use serrated jaw style. For bare aluminum wire only, smooth jaws.

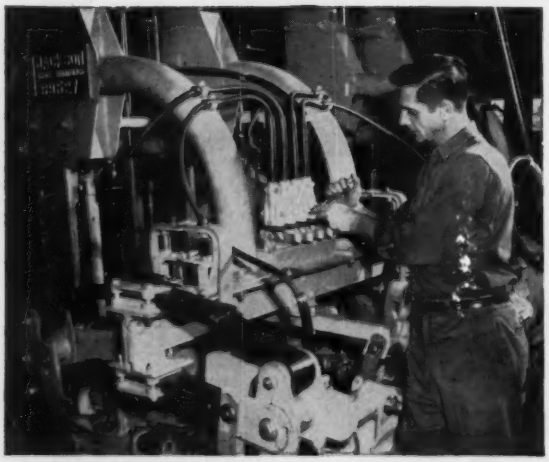
Write for Crescent Catalog No. 28 which illustrates and describes many valuable tools for linemen and other electrical workers.

Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

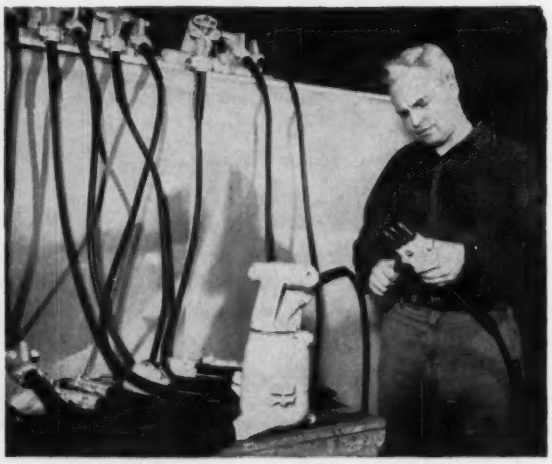
CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

"Tiger Brand Amerclad is the most

The completely self-contained Jackson Track Maintainer.



Tightening connectors. Machine delivers 4500, 2-ton blows per minute.



Assembling leads. Each vibrator delivers ¾ ton blow.

durable cable we've ever used"

says **ELECTRIC TAMPER & EQUIPMENT CO., Ludington, Michigan**

MANY years ago, the executives at Electric Tamper & Equipment Co. found out that when railroads order a piece of machinery, they expect it to last a long time—without breakdowns. Since then, Electric Tamper has won a high place in industry by producing a line of the hardest-working, *toughest* track maintenance machines on the market.

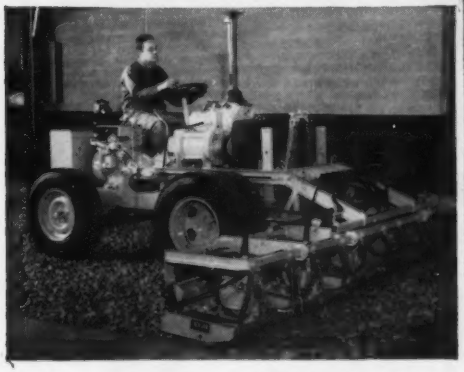
Leader of the line is the Jackson Track Maintainer, used for tamping ties. It has 8 powerful vibratory motors that drive 8 tamping assemblies. Each motor is powered with Tiger Brand Amerclad cable. The vibration and flexing (which are very severe) caused previous cable to crack until the jackets actually peeled away from the conductors. So they asked American Steel & Wire for advice.

Tiger Brand Amerclad was the solution. Finely stranded conductors soak up vibration and allow greater flexibility than ever before. The tough, well-cured jackets are impervious to oil, grease and the burning sun.

In the company's own words, "Tiger Brand cable is certainly superior to anything we have ever seen for this class of service. Its complete dependability under all service conditions has definitely helped us to maintain our good reputation in the field."

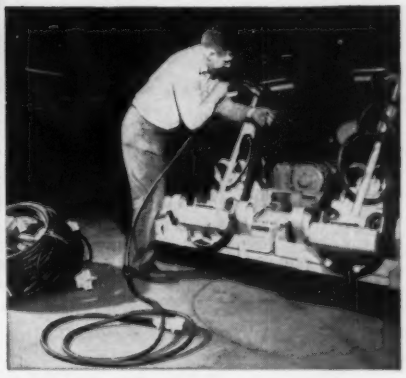
Do you want a *better* electrical cable—engineered for your equipment? Just call your American Steel & Wire representative.

The Jackson Multiple Compactor for consolidation of granular soil.



Hand Vibrospade. Cable usually drags on the ground.

Small compactor. See why they need durable cable?



AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL, GENERAL OFFICES: CLEVELAND, OHIO

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

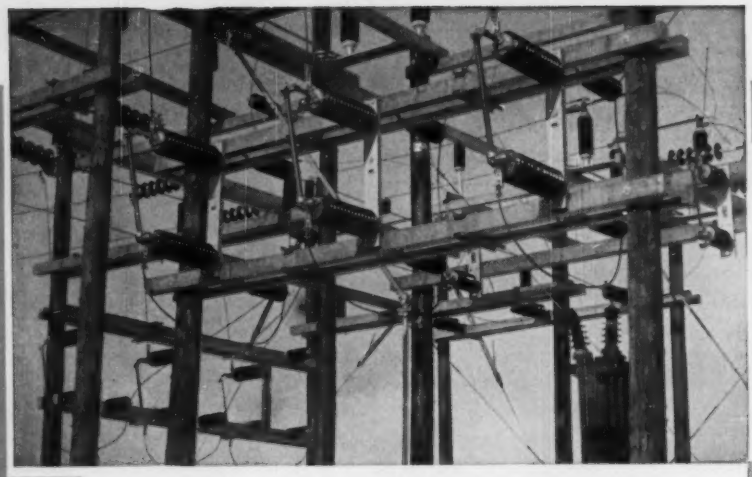
USS TIGER BRAND ELECTRICAL WIRE & CABLE

A STANDARD TIGER BRAND CABLE FOR EVERY SPECIAL JOB

- machine tool and building wire
- special purpose wire and cable
- asbestos wire and cable
- paper and varnished cambric cable
- aerial, underground and submarine cable
- shovel and dredge cable
- mold cured portable cord

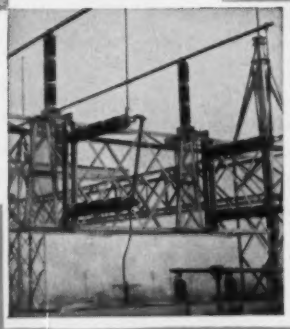
USS

UNITED STATES STEEL



MAINE—The 69 kv B Series Power Fuses shown at the left are in service for Maine Public Service Company at Presque Isle.

TEXAS—Below are some 138 kv Type HMH-1 Power Fuses in service at a Texas utility's substation. The Type HMH-1 is available in interrupting ratings up to 30,000 amps.



SOUTHERN STATES POWER FUSES SAVE UTILITIES UP TO $45 EACH TIME A FUSE BLOWS

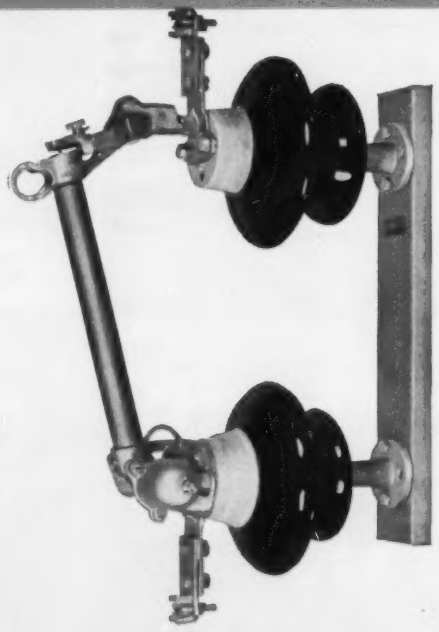
How much does it cost your company when a power fuse blows? Seventy cents to $3, or $5 to $50? By using inexpensive links instead of costly refills, Southern States power fuses may cut re-fusing costs as much as 800%.

There are additional savings, too. In a matter of minutes a lineman can re-fuse the unit, saving valuable time. No factory servicing is necessary. Expensive stocks of spares are eliminated. Less storage space is required. These all add up to savings too sizable to overlook. That is why utilities coast to coast are using Southern States Power Fuses.

These full dropout fuses are available to meet most requirements: Voltage ratings from 7.5-161 kv, continuous current ratings from 50-400 amps, and interrupting ratings up to 30,000 RMS amps. *Southern States Power Fuses have the highest interrupting capacity of any expulsion type fuse.*

They are not simply oversize cutouts, but have high mechanical strength to assure perfect performance for years, even after repeated operation. Snubber action allows the fuse holder to swing down to a cushioned, shock-free stop. Double-venting reduces shock force on insulators. Interchangeability of tubes permits increases in continuous current and interrupting ratings without changing fuse mountings.

Count the savings, check the advantages, and see why it will pay to use Southern States Power Fuses on your system.



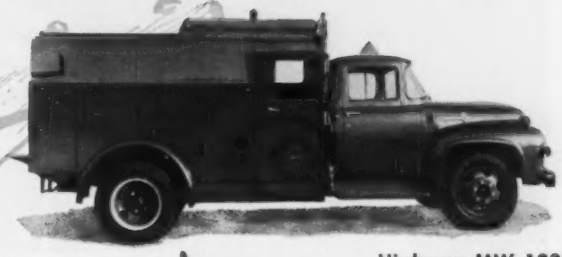
SOUTHERN STATES EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

HIGHWAY *Still The Leader*
In Utility and Construction Equipment

At Highway, utility equipment is designed, engineered and built for safe, dependable performance . . . specifically for the job required . . . and for long, trouble-free service life at low operating cost. A strict program of quality control has earned Highway the reputation as the leader in every detail of advanced utility equipment production.

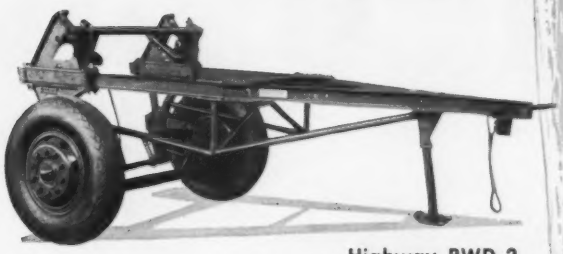
What are *your* needs or requirements in line construction and maintenance equipment? Let us show you how Highway's design, engineering and extensive production facilities can solve your problems.



Highway MW-128 Utility Truck Body

Highway heavy-duty HC Earth-Boring Machine

HIGHWAY



Highway PWD-2 Cable Reel Trailer

Highway IU-76 Installer's Unit

Highway PWD-2 Cable Reel Trailer is designed for quick, easy loading and transport of heavy cable reels up to 48" wide. Like other Highway utility trailers, it handles its load safely and steadily, even at high speeds on the road.

Highway MW-128 Utility Truck Body carries a full crew to the job with all necessary materials and equipment, on a standard truck chassis. Highway builds a full line of utility bodies for general and special service.

Highway IU-76 Installer's Unit is a specialized body for mounting on a half-ton truck. Scientifically arranged equipment compartments and tool carriers at sides and rear put all needed tools and materials within arm's reach.

Highway heavy-duty HC Earth-Boring Machine digs holes 9 to 36 inches in diameter, up to 10 feet deep in any soil. Portable, tractor-mounted, and self-powered models are also available.

HIGHWAY TRAILER CO.

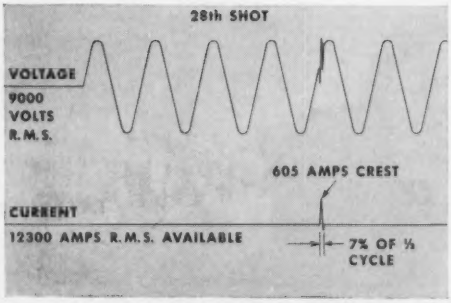
HEADQUARTERS • EDGERTON, WISCONSIN

MANUFACTURERS OF

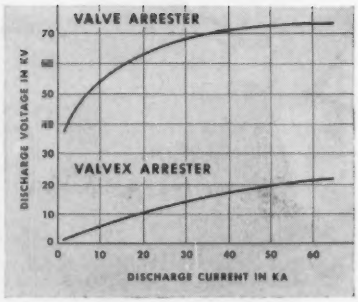
Utility Truck Bodies • Earth-Boring Machines • Pole and Cable Reel Trailers • Winches • Power Take-Offs • Service Accessories • Commercial Trailers • Trailerized Tanks • Dry Bulk Haulers

SALES AND SERVICE IN PRINCIPAL CITIES

At the 10th and 28th power-follow tests at plant setting of 9000 volts and 12,300-rms amps, tube and spiral of a 9-kv ValvEX arrester showed virtually no wear. Compare with new filler shown on the right.



Duration of current-follow on the 28th test was only .000583 second (7% of ½ cycle); peak current, less than 5% of rms plant setting (12,300 amps for each test).



ValvEX arrester discharge voltage is less than one third that of valve types—resulting in considerably lower winding stresses in the transformer protected.

Apply ValvEX® arresters

to *either* urban or rural locations!

The new Westinghouse De-ion® ValvEX arrester is a top performer both in rural areas where maximum surge currents occur and in urban systems where there are maximum fault currents. Twenty-five million arrester years of service with a failure rate of only 0.026% prove the principle of Westinghouse expulsion arresters. The ValvEX arrester, installed on all new Westinghouse "CSP®" transformers, combines the best features of both valve and expulsion types. This fact gives you the following advantages unmatched by arresters of any other type, design or manufacture:

1. The new spark-over levels, at less than half transformer BIL, are essentially equal in most ratings to valve types, actually better in others. These levels are 40% lower than early Westinghouse expulsion arresters which are still protecting transformers installed 20 years ago.

2. Higher surge-current capacity . . . tested up to 100,000 amps, a clear margin of extra capacity. The ValvEX arrester has an inherently low arc drop; little energy is absorbed. Open construction quickly exhausts gases to air, relieving pressure.

3. Lower discharge voltage on higher surge currents—less than one third of valve types. Prevents dangerous voltages from being impressed on transformer insulation.

4. ValvEX arresters in actual service pass *no* power-follow in *more than half* of all operations; when power-follow current does flow, it is limited to a small fraction of available fault current, its duration to a fraction of a half cycle.

In addition . . . ValvEX arresters are less sensitive to system overvoltages. They provide superior performance on repetitive strokes and on long tail surges . . . performance not possible with energy-absorbing valve arresters.

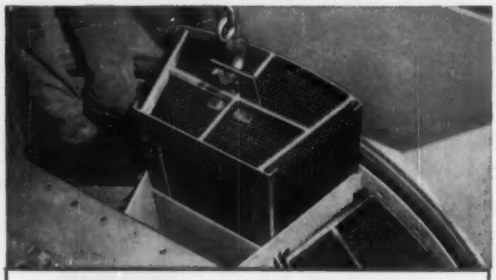
For more facts, call your Westinghouse sales engineer, or write, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70758

ValvEX arresters, installed on all Westinghouse "CSP" transformers, are universally reliable . . . at the substation or at the end of an exposed line.

YOU CAN BE SURE...IF IT'S

Westinghouse

air preheater installations are Ljungstrom®



Advantages of the Ljungstrom Air Preheater

- Size for size, recovers more heat than any other type.
- Reduces fuel consumption. Permits use of lower-grade fuels. Increases boiler output and reliability.
- Eliminates cold spots...keeps corrosion to a minimum.
- Easier, faster to clean and maintain.
- Requires far less supporting steel and is quickly erected.

MINIMUM CORROSION is an important reason. There are no cold spots in a Ljungstrom. Temperature is uniform on all heating surfaces—corrosion-causing condensation is reduced.

For all the facts, send now for a free copy of our 38-page manual.

The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

Public Service Co. of Indiana, Inc. communicates by G-E 2-way radio

Radio covers its entire system

All three operational divisions of the Public Service Company of Indiana depend upon General Electric 2-way radio to help coordinate the state's supply of vital electricity.

The all-duplex installation operates on the 25-50 mc band. District offices and generating plants maintain radio contact with service trucks and repair crews. Thanks in part to radio control, a continuous supply of electricity is generated and delivered to homes, municipalities, business and industry in 70 of the state's 90 counties.

Fourth year of service

For nearly 4 years, the G-E system has provided efficient radio service from 37 independent base stations. These coordinate the activities of more than 250 G-E equipped mobile units on 24-hour duty throughout the state.

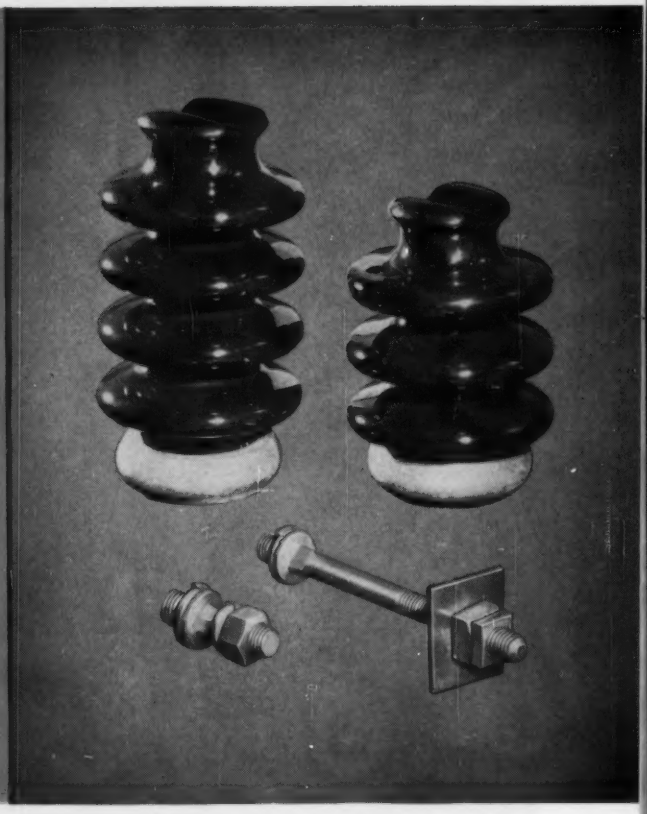
2-WAY MOBILE RADIO

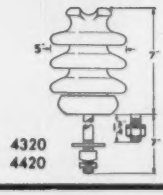
General Electric's new Progress Line of 2-way radio is available now to help your utility operations. Call in your G-E Communications Counselor, or write: *General Electric Co., Communication Equipment, Section X 1946-16. Electronics Park, Syracuse, New York.*

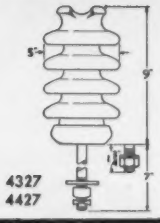
Progress Is Our Most Important Product

GENERAL ELECTRIC

LAPP DISTRIBUTION POST INSULATORS







CATALOG NUMBER — Short stud unit / Long stud unit	4320 / 4420	4327 / 4427
DIMENSIONS		
Leakage Distance, inches	11	15
Dry Arcing Distance, inches	5.75	7.6
MECHANICAL VALUES		
Cantilever Strength, pounds	1500	1500
ELECTRICAL VALUES		
Recommended Line Voltage, Kv	20	27
Low Frequency Dry Flashover, Kv	80	95
Low Frequency Wet Flashover, Kv	55	65
Impulse Flashover—Positive, Kv	105	135
Impulse Flashover—Negative, Kv	130	190
RADIO INTERFERENCE		
Test Voltage Rms to Ground, Kv	15	15
Max. RIV, Microvolts at 1,000 Kc	100	50
PACKING AND SHIPPING		
Net Weight, each, pounds	7.7	9.5

. . . trouble-free insulation for lines operating at voltages up to 25 Kv

NOW all the operating security of the famous Lapp Line Post insulator for transmission duty is available in a new series of Lapp Post insulators for distribution use—at voltages up to 25 Kv.

SOLID ONE-PIECE PORCELAIN. The body is a solid porcelain without internal hole, machined all over including conductor and tie wire grooves. Base is externally attached and studs are interchangeable—any required length being available.

FOG-TYPE. Multiple short petticoats, characteristic of Lapp Fog-Type design, provide an exposed uniform leakage path and self-cleaning feature—most efficient for duty in contaminated atmosphere.

LIGHTNING- AND MECHANICAL-ATTACK RESISTANT. Short sturdy petticoats—such as have been proved by nearly 25 years of service on Lapp Line Posts—provide greatest protection from damage by arcover and attack by stones or bullets.

NO CRACKING. The porcelain, held in the large-area low-intensity grip of its cemented-on base, can be loaded only in compression. No internal bursting forces can develop—permanently free from cracking.

PUNCTURE-PROOF. Solid electrical porcelain from conductor to base—no internal conductive pins, or even air space. Completely puncture proof.

RADIO-FREE. The Lapp Post design is inherently free from radio interference—requires no treatment or coatings. Dependably and permanently free from radio or television interference.

A *BETTER* DISTRIBUTION LINE AT *LOWER* COST...

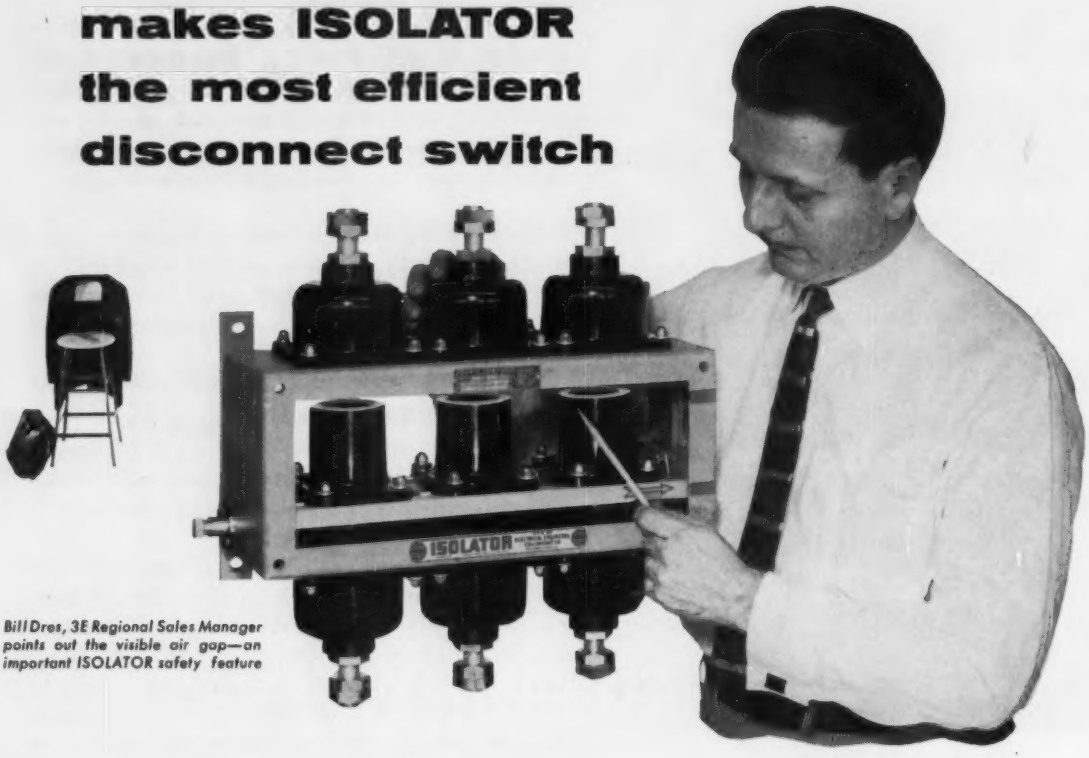
MOUNT LAPP POSTS *HORIZONTALLY*

You can eliminate cross-arms, braces, brackets and other hardware, by horizontal mounting of Lapp Distribution Posts. Such a line is trim and neat, and the insulators have even better electrical characteristics than when mounted vertically. (Several companies have used such a construction with regular Lapp Line Posts for periods up to 20 years—and they report that these lines have the best operating records of any lines on their systems!)

Lapp Insulator Co., Inc., Le Roy, N. Y.

Lapp

Straight line action makes ISOLATOR the most efficient disconnect switch



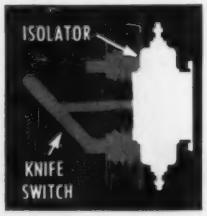
Bill Dres, 3E Regional Sales Manager points out the visible air gap—an important ISOLATOR safety feature

ISOLATORS save on cubicle construction and floor space because they take about ⅓ the space required by equally rated knife switches. They also weigh less and as all elements, including poles, are mounted and aligned on a rigid frame at 3E, they are simple to install.

ISOLATORS are safer ... in the open position, the gap between the bushings is easily visible. Yet the opening is narrow enough to lessen the chance of accidental contact with the live parts. The exposed studs at top and bottom are arranged for easy taping. When your men work in cubicles equipped with ISOLATORS they will be safe from live part hazards.

This switching center, designed and built entirely by 3E, shows how ISOLATORS make a compact, functional and handsome unit. These are, 5 KV, 200 ampere ISOLATORS. The ISOLATOR is also ideal in combination with potheads; any number of arrangements are possible and the units are easily interchanged if necessary. 3E makes many kinds of indoor and outdoor switches, and has a staff of engineers experienced in designing complete units for all types of special applications.

When the ISOLATOR moves from closed to open position its current carrying parts move in a straight line and telescope as contact is made. The parts are enclosed in insulated bushings which also telescope, shielding live parts and eliminating flash barriers.



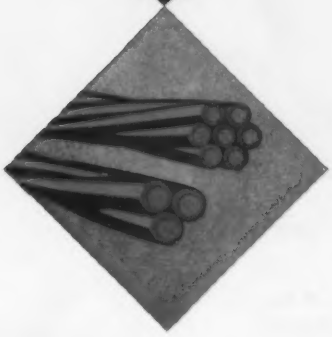
On your next switching problem, See 3E for recommendations and estimates.
For ISOLATOR data ask for Bulletin 140

ELECTRICAL ENGINEERS EQUIPMENT CO. Melrose Park, Illinois

3E

From the day they're installed...

and throughout the entire life of the line...



Copperweld Guys give safe, strong support at lowest cost per year!

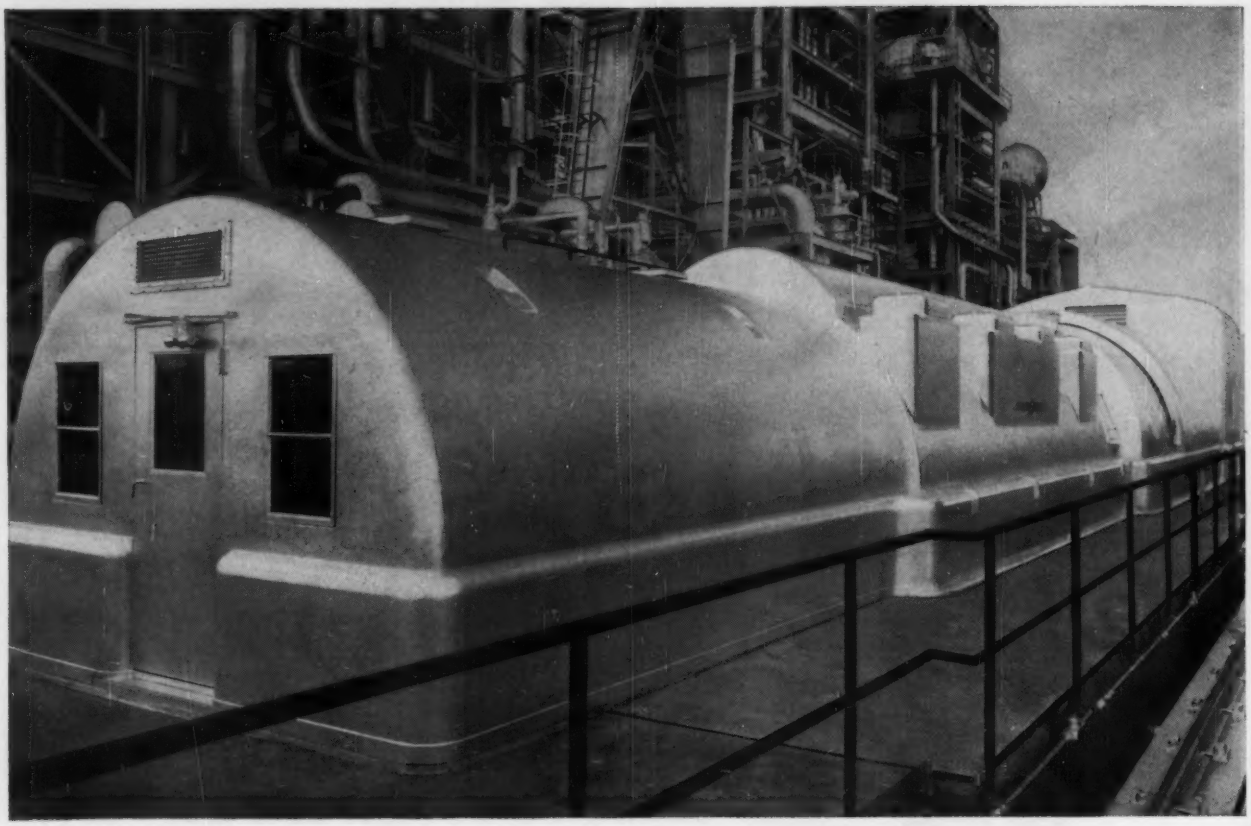
The permanent high strength of Copperweld* Guy Strand means permanent support for your overhead lines year-in and year-out. Guy repairs and replacements are eliminated once and for all. There's no doubt about it—the few extra pennies you pay for Copperweld Strand buy many extra years of dependable guying service. Why not start using Copperweld now—and save on upkeep every year for the life of your lines.

*Trade Mark

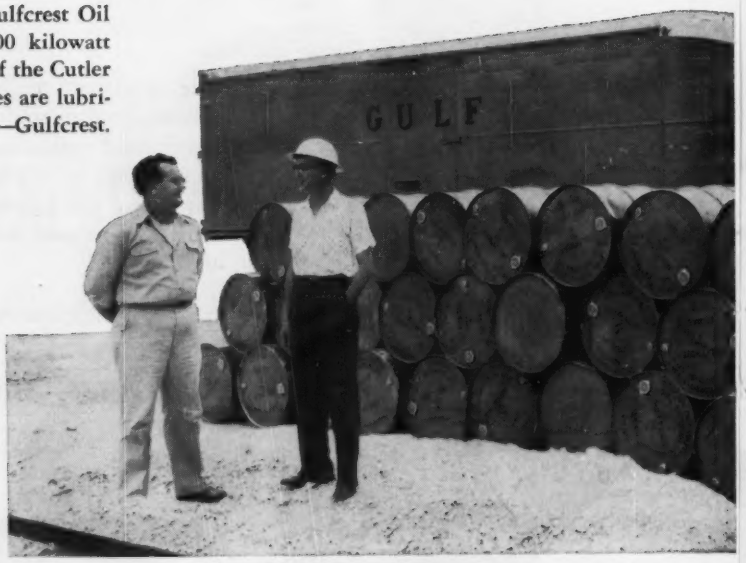
COPPERWELD STEEL COMPANY
WIRE AND CABLE DIVISION
Glassport, Pa.
For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

Copperweld
TRADE MARK
non-rusting GUY STRAND

***The Best** in Terms of Safety and Service!*



Part of the 100-drum shipment of Gulfcrest Oil which will lubricate the new 150,000 kilowatt turbine. This brings the total output of the Cutler Plant to 370,000 kilowatts. All turbines are lubricated with the finest in turbine oils—Gulfcrest.

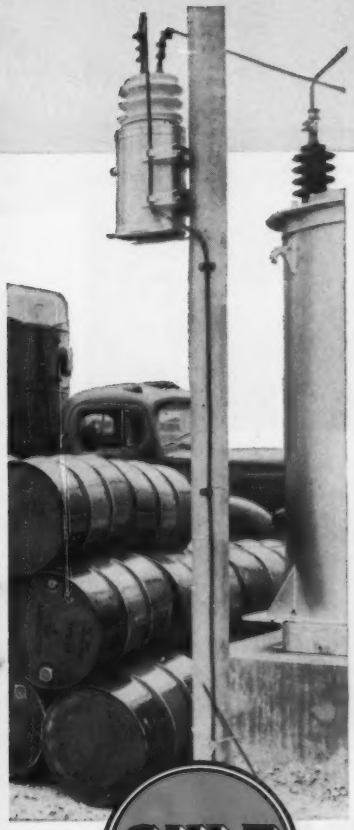


THE FINEST PETROLEUM PRODUCTS FOR ALL YOUR NEEDS

Past performance proved it best...

GULFCREST OIL

selected to lubricate another big turbine at Florida Power & Light Company



When the Florida Power & Light Company recently installed the new 150,000 kilowatt General Electric turbine in its ultra-modern Cutler Plant, the choice of a lubricant was no problem. The outstanding past performance of Gulfcrest in the four other units in the plant made it a natural selection.

Gulfcrest Oil has a background of superior performance in other Florida Power & Light Company plants, and in scores of other prominent utilities throughout Gulf's marketing territory. Here's why:

Gulfcrest Oil is super-refined by Gulf's exclusive Alchlor Process, which removes the unstable hydrocarbons that remain after normal refining. This discarded portion, if allowed to remain in a turbine oil, accelerates oxidation, increases neutralization number, forms sludge and harmful acids.

So to insure safe, long-lasting protection for your turbines, specify Gulfcrest—the world's finest turbine oil.

Call a Gulf Sales Engineer today and have him recommend the proper grade of Gulfcrest Oil to meet the specific requirements of your turbines. Consult the telephone directory for the number of your nearest Gulf office.

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Out where dependability counts

YOU NEED AN
INTERNATIONAL LIGHT-DUTY
4-WHEEL-DRIVE TRUCK

Whether the way leads by road or across country . . . *you can depend on* an INTERNATIONAL light-duty four-wheel-drive truck to deliver crew and equipment to the job site.

This INTERNATIONAL model S-120(4x4) can help the job schedule move faster, more surely. It goes anywhere, through sand, snow, mud . . . pulls through the bad spots . . . doesn't have to be driven the long way around.

It features exclusive INTERNATIONAL power take-off transfer case, plus optional power take-off transmission for auxiliary equipment. It's available in 4 tire sizes, for ample clearance, extra flotation and traction.

And like every INTERNATIONAL, it is all-truck built to save you the *BIG* money over the years . . . the operation and maintenance money. See your INTERNATIONAL Truck Dealer or Branch today, learn more about truck dependability!

INTERNATIONAL HARVESTER COMPANY • CHICAGO

Full-size, light-duty model S-120(4x4) gives you a gross vehicle weight of 7,000 lbs. Mounts pickup, Travelall,® service utility, stake or flat-bed body. Enjoy more convenience and comfort in exclusive Comfo-Vision cab. Short stroke, 131 horsepower BD-240 engine standard equipment.

Four-wheel-drive model S-160(4x4) with public utility body (right) has GVW of 15,000 lbs. Also available—model SA-140(4x4), 11,000 lbs. GVW.

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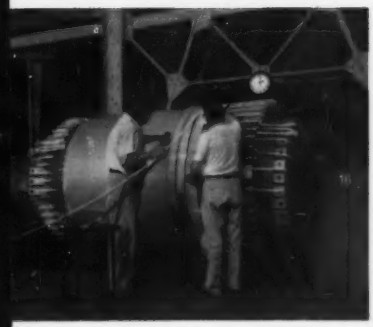
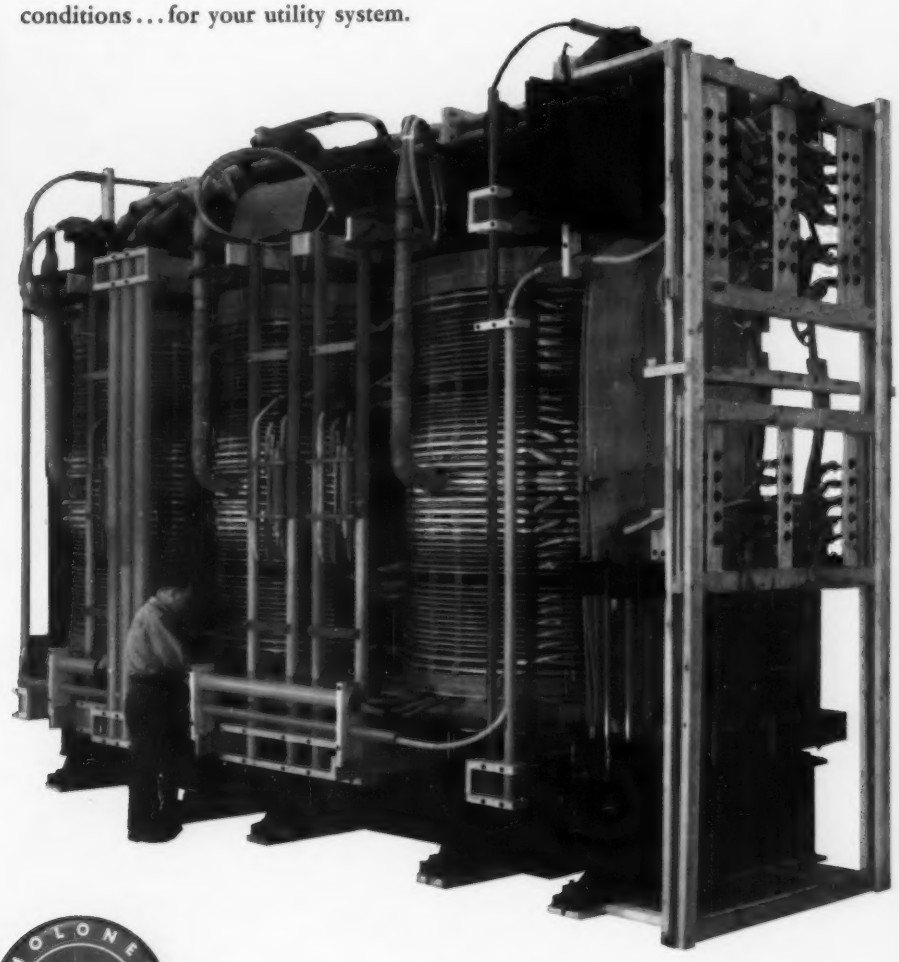
MEN AND MATERIALS...

combined with Moloney's extensive facilities,
produce core-and-coil units of superior quality
to withstand the most severe operating
conditions... for your utility system.





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SALES OFFICES IN ALL PRINCIPAL CITIES

SAFE DEHUMIDIFICATION

FOR MOLONEY

POWER TRANSFORMERS

Rapid, efficient moisture reduction to 1/10 grain per cubic foot, by controlled high velocity, parched air (85° to 100° C), dries Moloney core-and-coil units thoroughly —without damage to insulation.

For you, Moloney's dehydration process means greater dependability and longer life for every Moloney Power Transformer.

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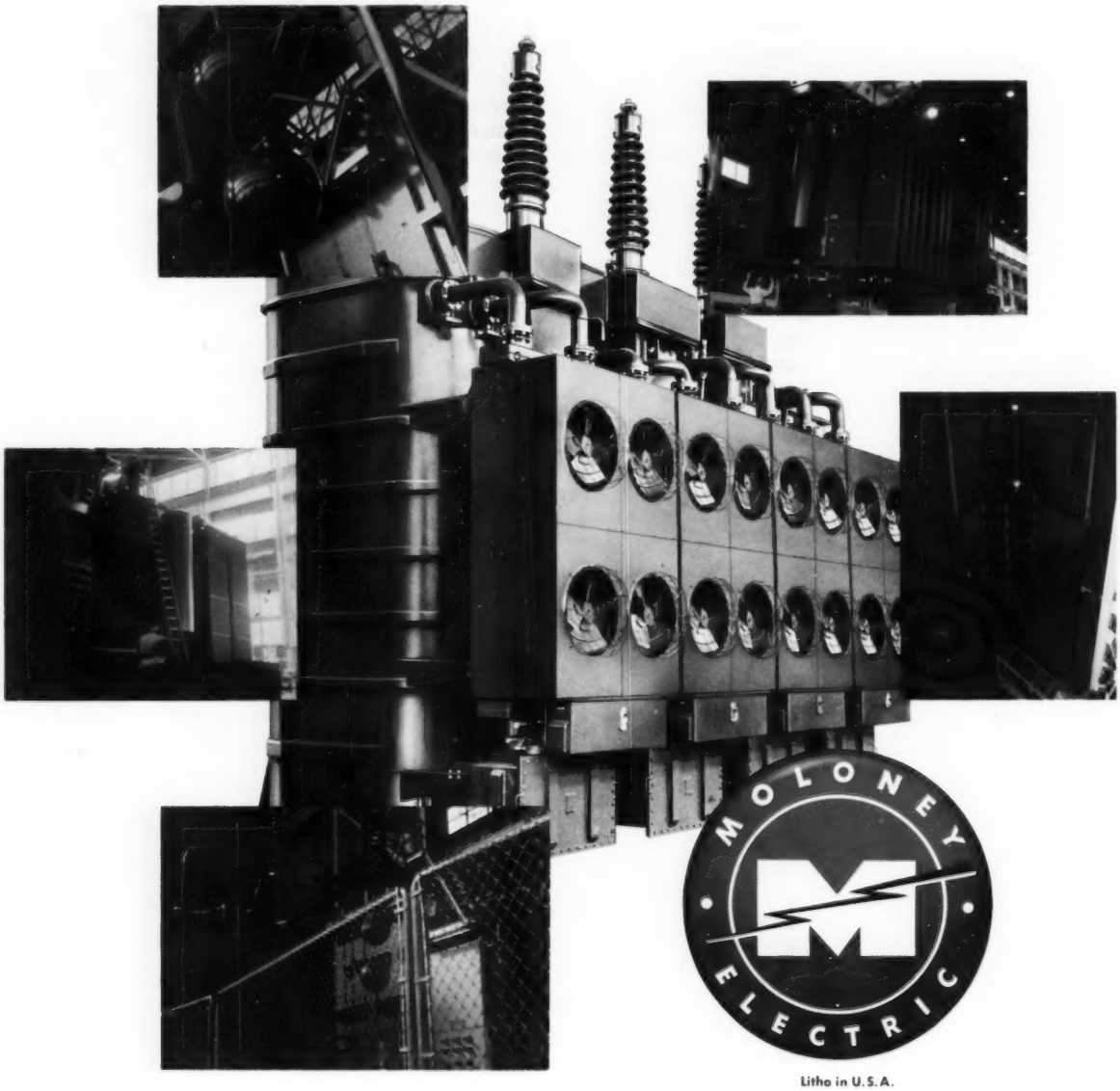
PROVED PERFORMANCE DEPENDABILITY

At Moloney, the most complete and finest test equipment in the industry is available to test-prove the performance dependability of every Moloney Power Transformer. Regardless of how exacting your test requirements are, Moloney can meet them . . . better!



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MOLONEY ELECTRIC COMPANY

Power Transformers • Distribution Transformers • Load Tap Changing Transformers
Regulating Transformers • Step Voltage Regulators • Primary Unit Substations • Secondary Unit
Substation Transformers • Network Transformers • Series Street Lighting Transformers
Subway Transformers • Industrial Dry Type Transformers • Capacitors • Magnetic Components For Electronics

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

EDITORIALS

From Where Is the Money Coming?

"Engineers need to have a basic understanding of utility financing," comments an electric utility president. "A lack of such understanding will certainly stand in their way of advancement." The same observation might be applied with equal validity to other personnel.

Specialization, while it serves the purposes of the day, should not preclude a broad understanding of the overall utility operation. Men who have risen to the top know that well. Certainly an appreciation of the various financial functions of a utility is a key part of the education of the rising executive.

There are other advantages also. An understanding of financing operations helps the engineer plan more comprehensively. It makes for better teamwork by bringing an appreciation of the other fellow's job.

To strip some of the mystery from the financial operations, Electrical World presents in this issue a special report on the very important task of raising money. We have sought to set aside some of the specialist's lingo in favor of the common language. And we have tried to bring out the point that a company's progress depends as much on efficient financing as on efficient engineering or efficient commercial operations.

The article is not designed to teach you how to direct the financial program of even the smallest utility. But it does show the general pattern and some of the difficulties involved when even the largest company must raise new money. And raising money is going to be an industry problem for many years if the progress we have so often predicted is to become a reality.

Are You Ready for Housepower?

What would happen this morning if a customer called your company with a question on HOUSEPOWER? Would the switchboard operator put the call through to the trouble department or the sales department? Has someone been specifically charged with the responsibility for handling HOUSEPOWER queries? Will your utility make individual HOUSEPOWER service calls initially, refer them to a specific electrical contractor, or refer callers to any contractor?

These questions must be answered immediately because the nationwide HOUSEPOWER program makes its big public debut this week. Most national ads and the $100,000 HOUSEPOWER contest refer readers to their local utility or local contractor for further information. The contest will be launched along with a series of ads and articles in the magazine, "Better Homes and Gardens," due on the news stands April 19.

It is up to the individual utility company to handle the queries and requests generated by the national and local advertising. But very little attention has been given to this phase of the campaign at the national level.

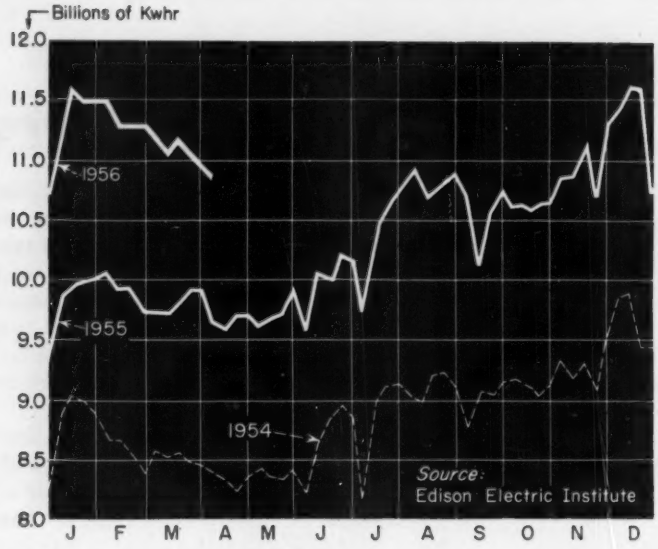
First calls will likely be in connection with the contest, and you can expect some dillies. "Where do I look for the fusebox?" "How can I tell the difference between a telephone and a power line?" "Is my house adequately wired if the TV works OK?"

Within a few weeks you will be getting the first returns from the contest. From these you will get leads on rewiring jobs and appliance prospects. By then you will certainly need well-planned policies for dealing with contractors.

Electric utilities which already sponsor active adequate wiring programs have the jump. It should require relatively little effort for them to organize for the HOUSEPOWER campaign. For those without an active program our special report published last year (EW, June 27, 1955, p 107) indicates some of the activities being carried on.

By the time television advertising program begins in September, utilities will be organized to handle their role in the campaign. But care must be taken to handle effectively queries in these first few weeks if the full benefits of the expensive campaign are to be realized.

ELECTRICAL WEEK



OUTPUT

Week ended April 7
10,846,000,000 Kwhr
Up 12.6%

Atomic Energy Commission requirements — 1,125,000,000 kwhr (Electrical World estimate). Excluding AEC output increases was 9.0%

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
April 7	+12.6	+14.5	+7.7	+17.3	+9.4	+13.2	+11.3	+11.0	+16.9	+6.6
Mar. 31	+12.1	+11.3	+8.2	+17.7	+8.9	+11.2	+12.6	+8.5	+13.2	+8.6
Mar. 24	+12.4	+7.6	+7.1	+18.8	+7.1	+15.2	+9.3	+6.4	+12.8	+7.5

Seasonally Adjusted Index 212.8 Week Ago 213.9 Year Ago 188.8

Issue's Highlights—Westinghouse pushes all-out production schedule for strike recovery; most plants on 6-day, 3-shift operation; more employees being added . . . AEC reveals details of runaway reactor accident at Arco, Idaho; incident seen affecting insurance issue . . . Consumers Power plans $500-million construction program . . . Tacoma City Light continues Mayfield Dam despite opposition . . . Pacific P&L will install electronic accounting center.

Westinghouse to Export Reactor—AEC has given approval to Westinghouse to sell to Belgium the first atomic power reactor for export by a private American firm. The 11,500-kw plant, to be displayed at 1958 Brussels world fair, was sold under a bilateral agreement with Belgium.

Installment Credit Outlook—While installment credit this year will increase only about $1 billion compared with $5.4 billion in 1955, appliance installment sales will be higher this year, A. O. Dietz, president of C.I.T. Financial Corp, predicts. He sees downward price trend for appliances as department stores adopt more competitive prices. "Fair-trading is on the way out. They can't enforce it," said Dietz.

Underground Line Finding—Massachusetts legislative committee has just reported against enforcing underground line construction above present legal requirements because of its excessive cost compared with overhead work. Finding came as fourth blizzard in three weeks hit New England area, bringing snow falls from 3 to 17 inches and service interruptions up to 24 hours in some regions.

Memphis to Buy TVA Properties—Memphis Light, Gas & Water Division expects to pay TVA "about $5 million" for local properties when Memphis starts generating its own electricity. Included in purchase will be substations, transmission towers, lines, rights-of-way, and possibly a generating plant.

NEWS OF THE INDUSTRY BRIEFLY TOLD

Washington Wire—AEC officials refuse to comment on statement by Prof Paul Scherrer, chief of Switzerland's AEC, that U. S. has discovered secret of harnessing thermonuclear process. Scherrer was quoted as saying in Geneva that development of workable process for thermonuclear power would take about another ten years but that method had been worked out in U. S.

President Eisenhower has signed into law the bill to authorize 1-million-kw, $760-million Upper Colorado River Storage Project. In signing, Eisenhower endorsed principle of basin-wide water development.

Short Term Money Tightens—Because of "very great" pressure on banks for loans they are looking carefully at compensating balances of all types of borrowers. Loans are being limited to those companies which have and will carry adequate balances. Because of nature of utility industry, it has not been large balance carrier. Financial experts point out that some regulatory authorities have not fully realized importance of allowing adequate working capital so that sufficient bank balance can be carried. This may result in adverse effect on utilities' financing flexibilities.

Oregon Commission Weighs Hells Canyon—Oregon Hydroelectric Commission has deferred decision on application of Idaho Power to construct Brownlee, Oxbow and Hells Canyon low head dams on Snake to study evidence from recent hearing. Also in the mill is consideration by Oregon's Water Resources Board, state's final appeal agency on water matters, of opinion by state's attorney general that federal license for project "does not override state authority to regulate use of water . . . or vested rights therein."

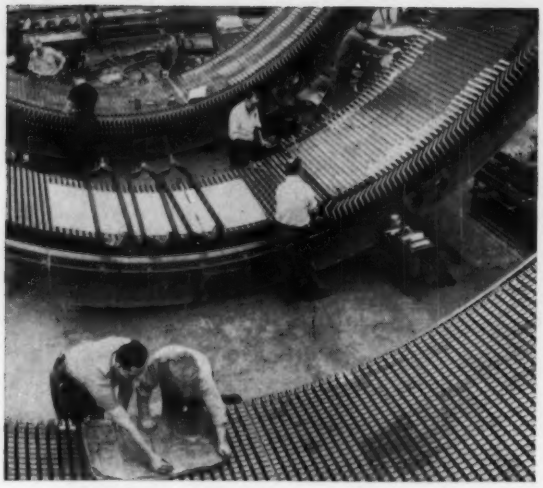
News From Co-ops—City of Piqua, Ohio, is considering long-term lease arrangement with Pioneer Rural Electric Co-op to operate 20,000-kw, $3.5-million plant to be financed by Pioneer. Pioneer now purchases 60% of its power from Piqua and 40% from Dayton P&L . . . Lamar County (Texas) Electric Co-op is adding 3,700 ft of floor space to its office building in Paris . . . Magic-Valley Electric Co-op, Texas, has mailed patronage refund checks totaling $98,000 to its 6,000 members. Co-op has paid over $500,000 in refunds.

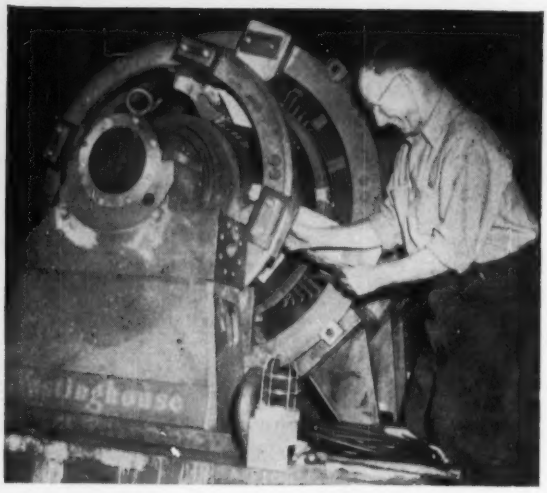
ABOUT PEOPLE IN THE INDUSTRY

Neither Portland GE, nor any other company in region, opposes federal power development per se, PGE Chairman Thomas W. Delzell told visiting newsmen. "What we object to is the deliberate attempt on the part of some persons to force the philosophy of federal power or nothing down our throats." Region's power problem is an "all-hands" job, and government had never been able to provide all power needed in area.

If avoidance of taxes "is to justify government in business in fully-developed area like New York, then our American free enterprise system, as it is known, is on its way out," Rochester G&E Pres A. M. Beebee notes in annual report. State development of Niagara and sale to investor-owned utilities of tax-exempt power, "should have no direct ill effect on the company. It is the principle involved that is bad. . . ."

More News About People page 190





Westinghouse Steps Up Production

- **Most plants operating on 6-day, 3-shift schedule to make up for time lost in recent 156-day strike which crippled company from October to March**
- **More than 95% of strikers back at work with more employees being added; advance planning set wheels ready to roll; aid provided by utilities cited**

The wheels are rolling full speed at Westinghouse Electric Corp where an all-out effort has been launched for a quick comeback after the 156-day strike which crippled company operations from October to March.

Throughout the strike the company's management had laid recovery plans, revising them from day to day as negotiations with the union dragged on. Last week P. T. Lagrone, manager of the company's electric utility sales department, commented, "We had up a full head of steam and the boilers were stoked so when the strike was over all we had to do was pull the throttle and we were off." (EW, Jan. 16, p 8.)

Pulling full throttle on production machinery at Westinghouse meant putting most plans on a six-day, three shift operation, hiring additional employees, and instituting "the largest advertising and promotion campaign in the company's 70-year history."

The utilities, Lagrone pointed out, had helped tremendously to pave the way for recovery. "The utilities," he said, "are wonderful people to do business with, for by nature of their business they operate on a long-term plan basis which means long-term buying of equipment. . . . The utilities' attitude was wonderful in co-operating to solve our problems."

Throughout the strike the company's research, engineering, and design work had continued helping to build up the steam needed to launch fast and full production. And within about two weeks after the strike, some 95% of the striking employees had returned to their jobs.

P. T. LAGRONE

"We had up a full head of steam . . ."

Turnover of personnel during the long weeks of negotiation and labor-management tension, Lagrone stated, had been somewhat less than normal.

As production mounted at Westinghouse last week, top management was still concerned with tying up the loose ends which remained after the five-year pact had been signed with the International Union of Electrical Workers.

The South Philadelphia plant of the Steam Division was still idle, pending revision of an incentive wage plan which would be satisfactory to all. And the status of 36 employees dismissed because of strike violence was still being weighed.

Of the 93 workers dismissed because of violence, 57 have been reinstated. The fate of the remaining 36 will be decided on a local level and, where necessary, will be submitted to arbitration. The dismissals proved a last minute stumbling block in negotiations to settle the strike.

Gwilym A. Price, Westinghouse president, recently counted up the toll which the long and crippling strike

had taken on his company. Losses in the first quarter of 1956 had totaled a probable $16 million, he said. And in the last quarter of 1955 losses had been about $1 million. Shipments during the strike, Price pointed out, had been approximately $300 million below pre-strike expectations for that period.

"For the final quarter of 1955," Price explained, "we were able to limit losses to 9¢ a share. This was partly because of the rigid economies we were able to effect, partly because the 58 plants which were operating had not then been materially affected by the shutdown of other plants, and partly because were able to make shipments of products from our pipelines of supplies.

"As the strike lengthened and our problems grew more acute, however, such losses increased. Our pipelines became gradually exhausted and sales quite naturally fell off. Furthermore, we began to feel the effect of the costs of the wage increases and other benefits accepted by the union and granted to other, non-represented employees. While final first quarter figures are not yet available, operating results in January and February indicate a loss for the first three months of 1956 of somewhat more than $1.00 a share."

But despite these losses, Price pointed out, "the financial structure of the company has remained sound, in part through the rigid economy measures effected during the strikes. . . ."

Price Predicts Bright Future

With a sound financial condition as a base for the future, Price predicted smooth sailing ahead for his company.

"New orders during 1955," he said, "were more than 12% above the rate received in 1954, and in the first two months of 1956 continued at an exceptionally high level. A large share of these new orders is in the field of heavy electrical apparatus. . . ."

"Backlogs of orders likewise are at very encouraging levels. In fact, it will take an all-out effort on the part of our plants merely to 'catch up' on customers' delivery requirements on past orders, at the same time they are working to meet commitments on new orders."

Price also pointed out that "Westinghouse is still . . . leader" in the field of atomic energy development which continued uninterrupted during the strike. New orders, he added, had also brightened the company's prospects in the field of defense products.

The consumers products field, he stated, "is one of our greatest challenges." And most of the company's big advertising-promotion drive will be concentrated in this field, he added.

The new campaign, Price said, will include increased advertising in daily newspapers and consumer magazines as well as increased cooperative advertising with dealers; the continued sponsorship of "Studio One" television program; and the company's sponsorship of the Columbia Broadcasting System's radio and television coverage of the political conventions, election campaigns, and election night returns. More emphasis will be placed on dealer relationships and promotion at the local levels, he added.

Westinghouse Unfolds Plant-by-Plant Recovery Plan

Motor & Control Division

Plant at Buffalo, N. Y.

Operation: 5% more production workers than at strike's start, increase of 10% in next 60 days predicted. Present operations on 3-shift, 6-day basis, to continue until production is current.

Outlook: Large control apparatus will be current within 5 to 6 months; control devices, integral horsepower motors current within 3 to 4 months.

Switchgear Division

Plant at East Pittsburgh, Pa.

Operation: Working force same as before strike, to be increased by 15% within 60 days. Operations on 3-shift, 6-day week, with Sunday work to be added where necessary to round out production schedule.

Outlook: Shipment on large switchgear apparatus seen to be current by October.

Generator Division

Plant at East Pittsburgh, Pa.

Operation: Working force same as before strike, to be increased by 10% within 60 days. Operations on 3-shift, 6-day week where possible.

Outlook: Shipments of medium-sized motors (under 1,500 hp) to be current within 6 months. Shipments on larger motors (1,500 to 10,000 hp) and steam and W. W. generators to be current sometime during first quarter of 1957.

Transformer Division

Plant at Sharon, Pa.

Operation: Number of production workers same as before strike, to be increased by 10% within 60 days. Operations on 3-shift, 6-day week. Production of power and distribution transformers to continue until shipments are current.

Outlook: Power and distribution transformer shipments seen to be current by end of 1956. Customer shipment situation on distribution transformers may be current within 3 to 4 months, with customer orders to be filled first, then warehouse stock.

Meter Division

Plant at Raleigh, N. C.

Operation: No production problems. Plant operated throughout strike.

Plant at Newark, N. J.

Operation: Operations on 6-day, 3-shift basis where necessary. Plan increase in production force by 10 to 15% within 60 days.

Outlook: Expect to be current on relays and instruments by Sept. 15, 1956.

AEC Studies Arco 'Runaway'

. . . of experimental breeder reactor core caused by human error; incident expected to affect talks on private plant insurability

Almost five months after an experimental breeder reactor got out of control and destroyed its core, the Atomic Energy Commission is able to clean up debris and begin to assess damages.

The accident occurred last Nov. 29 at AEC's reactor experiment station near Arco, Idaho (EW, April 2, p 74). It occurred during a routine series of tests in which more and more power was being developed to determine the behavior of the reactor and its elements.

The fatal test was the last in a particular series, and, when it appeared the pile was on the point of running away, the foreman of the operation told the man at the controls to shut the power off.

Wrong Button Pushed in Test

The operator misunderstood, pushed the normal shutdown button instead of the emergency switch, and the chain reaction got out of hand. This failure to remove reflecting rods, which boost the rate of reactivity, resulted in a buckling and melting of aluminum-clad uranium fuel rods and the escape of dangerous radioactivity into the atmosphere of the test building. Holes had been burned through the fuel elements and the coolant system pipeline. No one was hurt.

Damage was restricted to the reactor core and the inside shell of its vessel. However, distortion of the rod-like fuel elements was so severe that, when radioactivity had declined to a safe point by January for their removal, only a few could be withdrawn through the machined insertion holes in the heavy stainless steel lid of the reactor vessel.

The bulk of the elements are still in the highly contaminated core, and AEC is now building a heavy shielding arrangement over the whole works so it can remove in one fused piece the reactor lid and the elements stuck in it. All this will be consigned to a safe place for study and replacement, probably in a heavily shielded metal container.

AEC still does not know the extent of damage within the reactor core.

The reactor involved in the Arco incident was small. It cost $2 million to build, and its core was only about the size of a football, with fuel elements the size of elongated cigarets. This reactor was designed for safety testing, as was one AEC purposely exploded in July, 1954, at the same installation. In that test, it was found the radiation danger was limited to a small area.

Attention Focused on Insurance

The significance of the Arco accident lies in a current question as to the insurability of privately-owned atomic power plants. Industrial reactor experimenters have warned they cannot assume full financial risks associated with running atomic power plants near large population centers. Indeed, they have rejected as inadequate the offers of private insurance carriers to insure each atomic facility against $65 million in liability claims.

The private developers have indicated the only solution to the problem is establishment of a government indemnity program to cover liability over and above the insurance companies' ability to underwrite.

The industrialists agree with the insurance companies and federal officials that there is little likelihood of a carefully designed and cautiously operated reactor getting out of hand and causing damage.

Accident Underscores a Fear

Nevertheless, they insist that (1) there is always a possibility that an accident could occur, and (2) if one did occur, the damages would threaten the solvency of the nation's biggest corporations. Claims could run into the billions.

This fear is bound to be underscored by the Arco runaway. True, the accident did occur while AEC was pushing the pint-sized plant as hard as it would go. And, true, fail-safe automatic shutoff devices are said to have been disconnected so overpowering could be accomplished.

Nevertheless, one fact stands out—and a wartime secrecy grip by AEC could not keep it quiet:

A reactor did get out of hand, and because of a human error.

It's a fact that will probably figure in discussions of the insurance question.

AEC officials, quizzed as the story leaked out during the last few weeks, emphasized that they still don't know the extent of damage done to the reactor at Arco. But they made these pertinent observations:

- They do not know what would have happened if the reactor was not shut down when it was.
- The knowledge gained in their cleanup will aid in assessing the possible extent of damage in the blowup of a bigger reactor, such as the huge power plants planned by industry.

AEC, North American Plan Test Organic Moderator

Construction will begin this year on a small, 5,000- to 15,000-kw organic moderated nuclear reactor at the Atomic Energy Commission's national reactor testing station in Idaho.

The experimental facility will test feasibility of using the hydrocarbon diphenyl as a moderating and cooling material. It will cost $1.8 million, with the builder, North American Aviation's Atomics International Division, putting up $750,000.

North American has been conducting research on such a plant. The new reactor will simulate conditions of heat transfer, temperature and coolant flow which would exist in a large power reactor. AEC wants to determine the advantages, such as low induced radioactivity, low corrosion of fuel elements, and high boiling point, of an organic moderator.

The reactor's fuel elements will be highly enriched in U-235. It is expected to go into operation early in 1957.

Omission Error

In the April 2 special report, "The Heat Storm Goes Underground", Electrical World inadvertently omitted the name of C. A. Bauer, Commonwealth Edison Co, from the roster (page 104) of the AIEE Soil Thermal Resistivity Research Project Subcommittee 14. To Mr Bauer, co-author of an article in this special report, our sincere apologies.

The Editors

260 Reservoirs Foreseen in California Water Plan

Some 260 new major reservoirs should eventually be constructed in California with total cost of fully developing the state's water resources estimated at about $13 billion.

These are highlights in a preview of the California Water Plan released by the State Water Resources Board. The plan, intended as a master plan for all future California water development, is expected to be completed by summer.

Studies were begun by the state division of water resources in 1947 at the direction of the legislature. The state engineers estimate current annual overdraft at 5-million acre ft—mostly from groundwater pumping.

To compensate for this overdraft and to satisfy future needs, some 21-million acre ft a year should be exported from the north coastal area (Trinity, Klamath, and Eel Rivers) and from the Sacramento Valley. This water would be carried to deficient areas of the state as far south as San Diego. Most water use would be made in the San Joaquin Valley. Power facilities would be part of the projects.

The state legislature is considering a bill to put water resources development in a separate state department. Initial funds for start of widescale development also are up for vote. The money would be for the $1.5-billion Feather River Project described in the report as the first unit of the California Water Plan. Its cost is included in the $13-billion total.

Submetering Bill Vetoed by New York's Governor

A bill to permit submetering of electricity by New York commercial landlords to tenants, with an accompanying decrease of the landlords' rates, was vetoed by Gov Averell Harriman recently.

The bill "does not reflect responsible legislative action," Harriman said. The State Public Service Commission called it "parasitic and undesirable."

Estimates placed the amount of a rate change clause in the bill at $7.5 million. Rate hikes to other consumers would have been needed, according to Consolidated Edison Co of New York, Inc, spokesmen, to make up decreased charges to landlords.

Obstacles Fail to Halt Cowlitz Project

Work on Tacoma City Light Co's $37.1-million Mayfield Dam on the Cowlitz River, Wash., continues despite various obstacles such as the recent injunction which prevents the city from actually blocking the river.

Workmen (above) held by safety ropes, drill away on a stone cliff to prepare an abutment for Mayfield, first of two dams in the city's $124-million hydroelectric project.

The city's latest obstacle, in addition to stone cliffs, is the threat of an initiative asking for a law to prevent municipalities from constructing dams within the river's fish sanctuary established several years ago. The initiative, to be presented by the state Sportsmen's Council to the voters next fall, is the second legal difficulty encountered by the city. An $80-million suit against Tacoma, filed by the Cowlitz Indians on jurisdictional grounds, was recently dismissed.

Meanwhile, Washington's Gov B. Langlie has renewed his criticism of the project. In a recent speech to the Young Businessmen's Club in Tacoma, he contended that high construction costs would make the power too costly. He suggested the city wait 10 or 15 years before proceeding with the project, although contracts totaling some $17 million have been awarded for the Mayfield Dam and powerhouse.

The governor referred to an action now pending before the state supreme court, which seeks to halt construction of the dam, and to a 1949 law which prohibits high dams such as Mayfield to preserve fish runs.

"If the city, through the courts, can bypass the state law, there will be no further controversy," Langlie said. "But until that decision is forthcoming, I have no other course but to insist that rights of the fisheries department, as proclaimed by the state legislature, be sustained."

Dean Barline, Tacoma utilities director, challenged Langlie's description of the project as a high-cost undertaking, and declared that with funds now being used to buy power from Bonneville Power Administration, "we could pay for Mayfield Dam . . . in about 16 years."

$500-Million Expansion Set

. . . by Consumers Power for five-year construction program; 94% increase in electric generating resources seen by 1962

Consumers Power Co has announced a whopping expansion program calling for a $500-million construction outlay over the next five years, a 1-million-kw boost in generating capacity, and a $100-million hike in annual operating revenues.

In announcing the program at a recent meeting of the New York Society of Security Analysts, Consumers Pres Dan E. Karn said the expansion was necessary to meet the electric and natural gas service growth of its outstate Michigan area between now and 1960.

The expansion plan calls for 1-million kw of generating capacity to be added by the end of 1962, while actual capacity is expected to rise by 718,750 kw during the five-year program. This would increase present capacity from 1,557,718 kw to 2,276,468 kw by 1960.

Karn said the 1-million-kw program is in addition to current construction. This construction now under way includes three additions of 156,250 kw each at existing plants and will provide 468,750 kw of new capacity between 1956 and 1958.

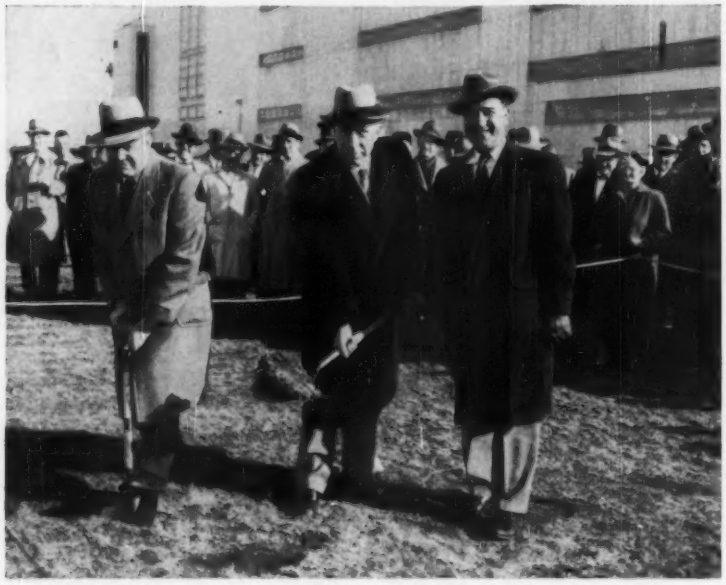
The new plans call for construction of four 250,000-kw units scheduled for service between 1959 and 1962. The first unit will be built adjacent to the company's Weadock Plant on Saginaw Bay, with completion date set for 1959.

Present and projected construction, all in thermal-type units, is expected to increase electric generating resources by 94% to a total of more than 3-million kw by 1962. With a record $91-million program budgeted for 1956, Karn predicted that such expenditures in 1960 would reach an annual level of $125 million.

Based on the estimated $100-million increase in annual electric and gas operating revenues by 1960, Karn said revenues that year should total about $290 million, with $195 million in electric revenues and $95 million in gas revenues. This would compare with an overall total of $189,431,000 for 1955, with totals for electric and gas at $128.7 million and $59.8 million, respectively.

The 1956 outlook for earnings, Karn predicted, would be "in the order of $3.25 per share on shares presently outstanding," compared with 1955's $3.09 a share. He said the company is currently paying cash dividends at the annual rate of $2.20 on the common stock.

Turning to population trends in the company's service area, which comprises 64 of the 68 counties in Michigan's lower peninsula area, Karn said a rise from the present figure of 3.5-million to a 4-million total by 1960 was indicated. He said the company was serving an aggregate total of 1,214,000 electric and gas accounts at the end of 1955, representing 1,019,000 individual customers.



Work Starts on Salem Harbor Unit

Ground breaking ceremonies, above, marked the start of Salem Harbor Steam Plant's 140,000-kw unit recently. Pres Irwin L. Moore, center, New England Electric System, said the $20-million addition will raise the plant's capacity to 300,000 kw when it goes on the line in 1958.

The system has spent about $330 million, Moore stated, in expanding and modernizing in the last ten years. He's aided here by Salem Mayor Francis X. Collins, left, and Donald Meo, president of the Chamber of Commerce.

Union Accepts GE Bid; Westinghouse Debating

The United Electrical Workers, Independent, has accepted General Electric Co's contract proposed last July. Similar to the agreement reached last August with International Union of Electrical Workers, the proposal affects 20,000 GE workers in 24 plants.

Workers would get wage increases of 4½¢ to 17¢ an hour effective immediately, and a 3% general hike during the remaining four years of a five-year contract. The proposal is now bound for U. S. union locals for ratification.

Meanwhile, Westinghouse Electric Corp considered halting contract negotiations with Local 107, United Electrical Workers, because of violence at its Lester steam turbine plant where 6,000 workers have been out since Oct. 15.

Pacific P&L Will Install Electronic Accounting

Pacific Power & Light Co, Portland, Ore., has completed plans for the installation of about $1 million worth of high-speed electronic and related automatic equipment to handle customer accounts.

Decision to install electronic equipment is based on four years of study by the company and Stanford Research Institute, said PP&L's Pres Paul B. McKee. Installation and operation of the equipment will be under the direction of George F. Mackenzie, company treasurer.

Studies have shown the investment will speed routine accounting operations with resulting economies. In addition the computer will make possible quick and efficient calculations for many engineering problems and the rapid analysis of a wide range of business data.

Installation of the computer in about one year will release personnel from routine tasks and make them available for more interesting and productive activities, McKee said. Training program to prepare employees for new work is included in the plan.

As part of the electronic accounting process, customer meter readings will be marked on cards which will be "read" electronically. Information will be relayed automatically step-by-step through punch cards and magnetic tapes until the finished bill comes out ready for mailing. Electronic "auditors" will flag any unusual variations in month-to-month meter readings and set out the particular account to be checked for possible error.

MODEL OF ELECTRONIC ACCOUNTING CENTER is inspected by Pacific P & L's Treas G. F. Mackenzie (1), head of installation, and Pres Paul B. McKee

Equipment contains 1,500 dual and triple-purpose electronic tubes. Entire installation represents an electrical load of about 70 kw. It will be installed in an air-conditioned room, where humidity and dust can be controlled. For use in design planning, the computer will be capable of such things as network power flow calculations. When customer accounting has been transferred to the new equipment, other phases of record-keeping gradually will be adapted to the electronic system.

Orders for the computer equipment were placed with ElectroData Corp, Pasadena, Calif., and IBM Corp following approval of the project by PP&L's board of directors.

New England Meets Power Problems With Atomic Plans

The proposal to build Yankee Atomic Electric Co's 134,000-kw nuclear plant is the result of utility research into long-range fuel problems confronting New England.

This was pointed out by Roger J. Coe, Yankee Atomic vice president, at the New England Council's 122nd quarterly meeting in Providence, R. I.

Since nearly all hydro sites in New England have been developed, he said, most future generation must come from plants burning fossil fuels. Coe cited three problems this development poses for New England firms:

1. Continuing rise of coal and oil costs.

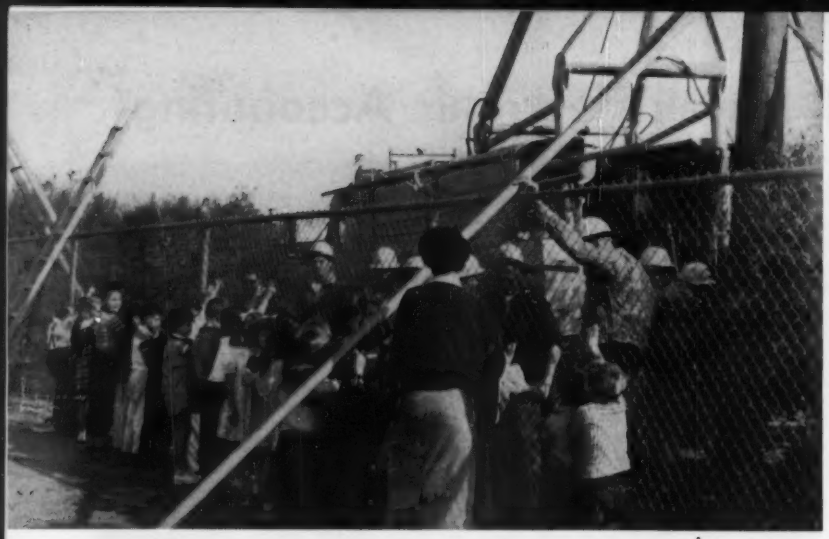
2. Transporting coal or oil which costs as much as the fuel itself.

3. Dwindling resources of economically recoverable coal and oil.

For a regional solution, the 12 Yankee Atomic participating companies proposed a 134,000-kw atomic power plant for which the Atomic Energy Commission recently approved the design (EW, Feb. 20, p 96). Tentative start-of-construction date has been set for spring of 1957 at a site near Rowe, Mass. And the project, costing in the neighborhood of $250 per kw, will probably be in full operation by the middle of 1960, Coe said. The company will spend about $35 million for the plant, and the government will underwrite several millions toward reactor core and fuel system design.

Coe qualified the project's tentative starting date by saying: "If this type of nuclear plant (pressurized water reactor) looks as sensible to us then as it does now; if the firmed-up cost estimates are not substantially higher than at present; and if the (public liability) insurance question straightens out—the first shovel-full of dirt will fly at Rowe next spring."

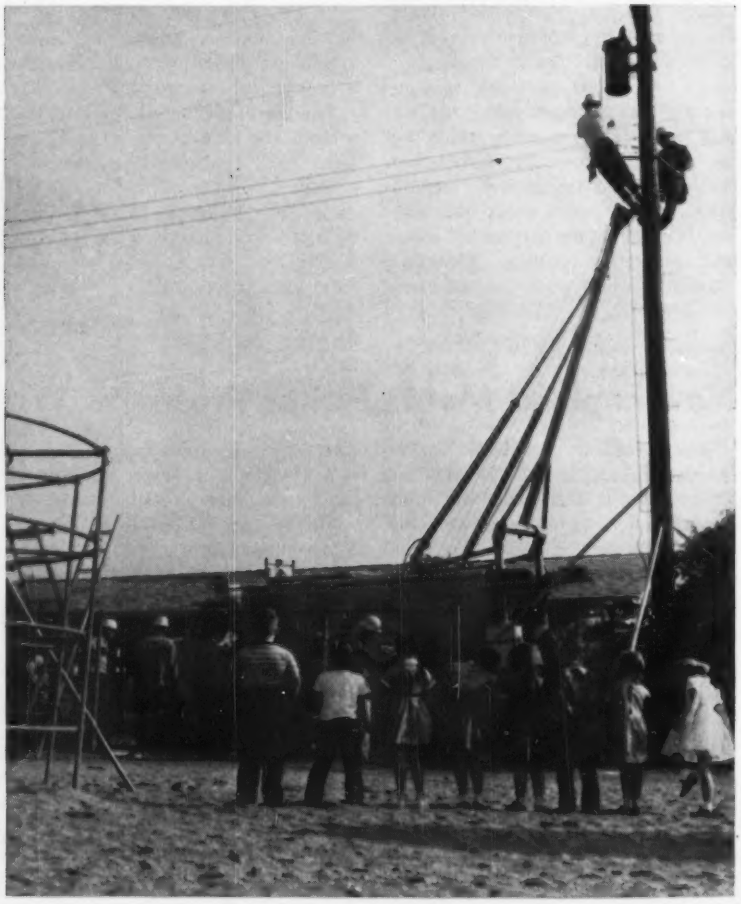
The participating companies, he said, are confident that these three "ifs" will work out, and that remaining arrangements with the AEC, construction contracting, and financing will be accomplished.



1 Southern California Edison Co line crew found itself besieged by eager questioners during erection of transformer pole next to grade school. Instead of shooing kids, Crew Chief Neil Cunningham turned event to profit staging demonstration with explanations for the children.

Southern California Edison Co Crew . . .

'Captures' First Graders with

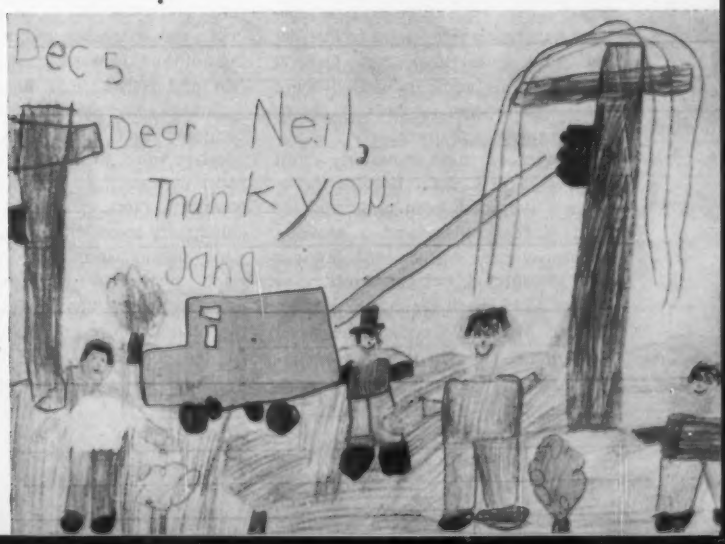


2 Crew members and first graders were introduced to each other. All questions were carefully answered. At same time, elemental facts about electricity and safety were explained to tomorrow's homemakers. Teacher was also present most of time and helped coordinate the demonstration.

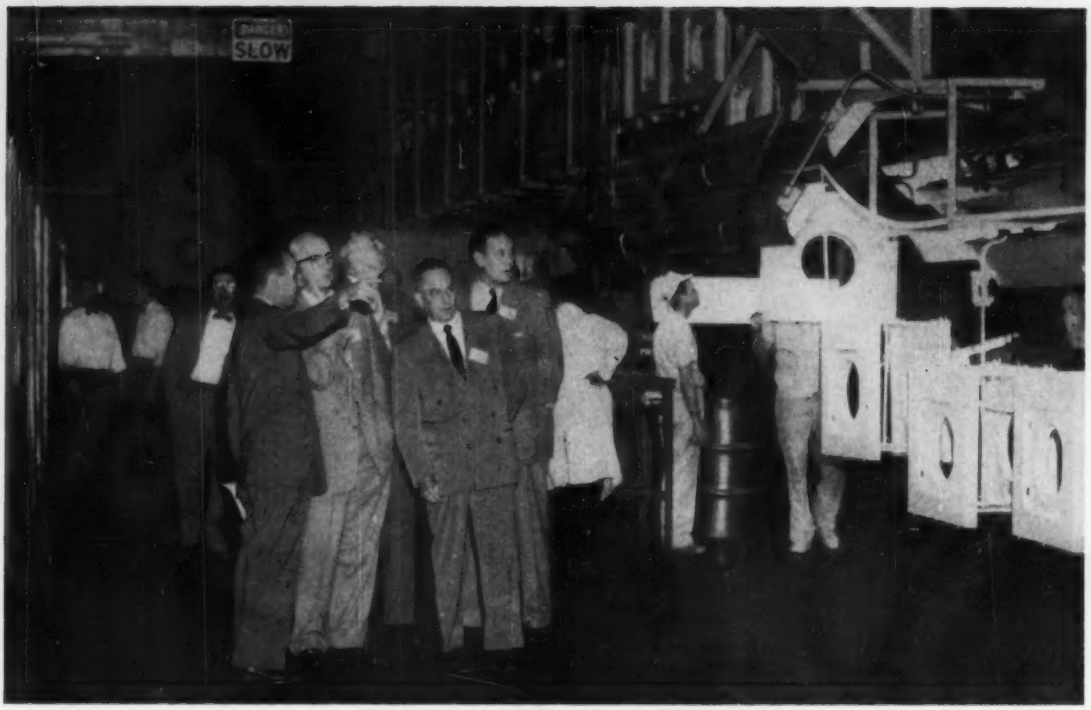
3 Function of pulling device is explained to eager listeners who also enjoyed trying on safety helmets. Children wanted to know: "Why are your hats yellow?" and "How do you get up the pole?" Among other things, children were told never to pick up a wire hanging from pole.

Pole Demonstration

4 Back in the classroom, children show that demonstration left vivid impressions. To the first graders of Monte Vista School henceforth, electricity will mean more than something strange that makes the lights go at the touch of a switch.



5 The deeds and exploits of the SCE crew are recorded in crayon for . . . well, maybe not posterity . . . but certainly the delight of crew members. They also received "Thank You" notes from the first graders for the demonstration.



PP&L FLEW 55 INDUSTRIALISTS TO LOUISVILLE TO SEE AUTOMATION IN ACTION AT FOUR APPLIANCE PLANTS

Response Is Immediate When . . .

PP&L Tells Automation Story

J. M. STEDMAN, Manager, Business Development Dept, Pennsylvania Power & Light Co, Allentown, Pa.

Forums on automation to stimulate understanding and appreciation of automation's value among industry executives have been launched by the Pennsylvania Power & Light Co, with help of General Electric Co. The response was immediate and enthusiastic. As a result signs point to the fact that now more than ever Central Eastern Pennsylvania industrialists are looking for places in their plants to employ automated machinery.

The decision to do something about automation in Central Eastern Pennsylvania stemmed from a natural interest in the subject and a growing concern over the way its meaning was being interpreted and publicized.

Since 1948 when Delmar S. Harder of Ford Motor Co coined the word —which he originally defined as meaning "handling parts between successive production operations" — the term "automation" has come to have almost as many meanings as there are people attempting to define it. In the resulting confusion, many believed automation was a new, revolutionary process that would wreak vast unemployment and economic chaos. Although facts have continually proved this to be a false concept, the extensive publicity attacking automation was creating a growing fear and resistance to its acceptance.

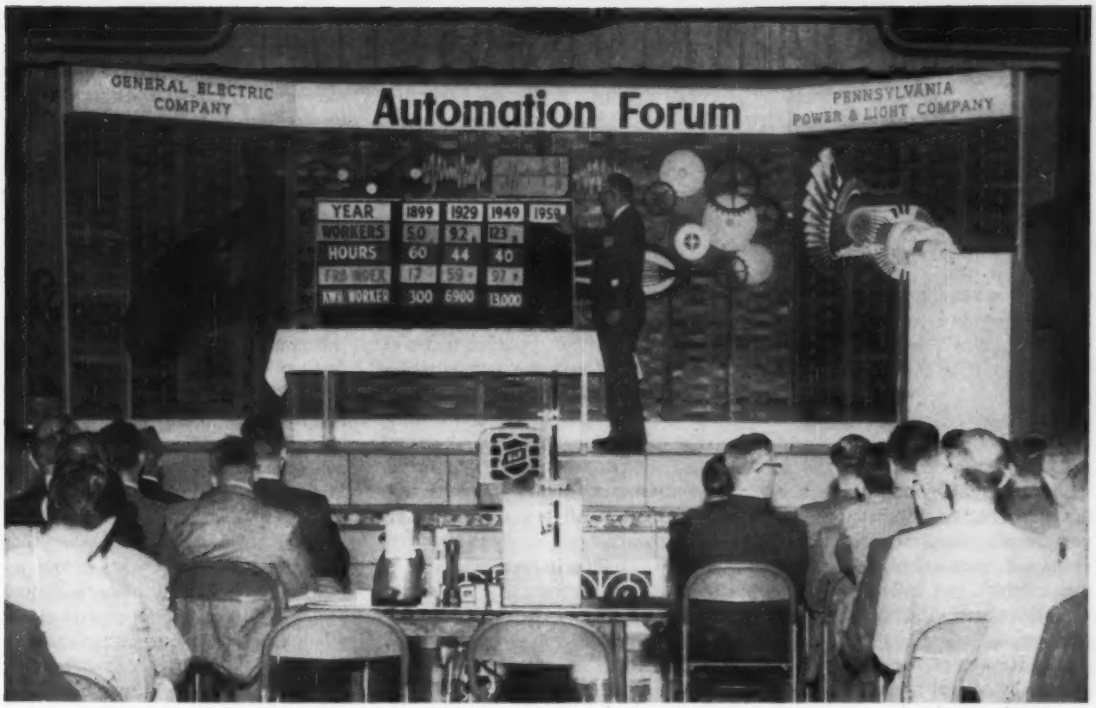
Studies had long convinced the company that automation simply is another word for technological progress — that it is a desirable trend toward a more effective use of machinery for more efficient performance and greater individual production. Each phase of this technological progress merely has been a step along the road to more and better products for the consumer; to greater production and less error and spoilage for the manufacturer; and to larger real earnings, fewer hazards, and less physical effort for the worker.

From this analysis it was determined that the proposed forums on automation should encompass two specific objectives:

- To bring about a better understanding of automation.
- To demonstrate its practical application value to the production needs of Central Eastern Pennsylvania industry.

It was decided that the most effective way to prove the value of automation would be to demonstrate it in action. GE's Appliance Park at Louisville, Ky., was chosen for this demonstration because the plant was in an ideal location and could point up the advantages of automation in large-scale industrial production. Thus the Industrial Executive Automation Conference began to take definite shape.

After the program was established,


GENERAL ELECTRIC COMPANY
Automation Forum
PENNSYLVANIA POWER & LIGHT COMPANY
YEAR 1899 1929 1949 1958
WORKERS 50 92 123
HOURS 60 44 40
FRB INDEX 17 59 97
KWH WORKER 300 6900 13,000

LOCAL FORUMS FEATURED VISUAL AIDS, EXHIBITS, AND SCALE MODELS BY WHICH AUTOMATION WAS DRAMATIZED

to Its Industrial Customers

personal invitations were extended to selected industrial leaders in Central Eastern Pennsylvania. Interest was immediately apparent. In a short time, 55 executives from a widely diversified and representative group of area industries accepted the invitation.

Automation Dramatized

A highlight of the Louisville conference was a guided tour of four of the five manufacturing plants at Appliance Park. The evolution of materials from basic components to finished appliances was described in step-by-step detail. (This entire project includes a 45-mile conveyor system which carries parts to work locations on split-second scheduling. A major electric appliance emerges from the production line every 2.5 sec.) Behind this amazing production record the industrial leaders saw what many industries can accomplish with the efficiency of automation, backed by a sound, progressive management philosophy.

Throughout the Louisville conference, the keen interest of the guests was clearly evident. Questions about specific applications showed that many industrialists already were visualizing how they could put automation to work in their own plants. This was confirmed later in letters received —almost all of which contained comments like this:

". . . the trip was very enjoyable, informative, and full of ideas for present and future application . . ."

We learned three important facts from the Louisville conference: First, that industrial management is extremely interested in the subject of automation; second, that many customers are looking for practical and proven methods for improving their production facilities; and third, that a frank discussion and presentation of the facts of automation is the most effective way to reveal its true meaning and industrial value.

An important objective included in the plans for our second automation activity was to get the story to a much larger number of our customers than we could invite to the Louisville conference. The most practical way to achieve this goal was to present the Louisville story at meetings held in PP&L's service area.

Having had considerable experience with industrial mass sales promotions and being familiar with "Productivity Forums," the company conceived the idea of holding a similar type of program keyed to the automation theme. The suggestion was well received at GE, and the second cooperative automation program soon evolved.

As plans developed, it was decided to hold three similar meetings on successive days at Bloomsburg, Harrisburg, and Allentown. These locations, about 80 miles apart, are the geo-

graphical centers for the industrial customers in our service area, and an attendance goal of about 150 people at each location was set.

To present the automation story, an all-day program running from 9:30 to 4 o'clock, was arranged. At each meeting PP&L division vice presidents gave the opening and closing remarks. Seven manufacturing executives from Philadelphia; Schenectady, N. Y.; and Shelbyville, Ind., discussed the latest techniques and ideas for improving industrial productivity.

The presentations ranged from the effects of today's research on the further development of automation processes to new ways of increasing production by full use of modern materials-handling methods, electronic and electric heating, and automatic controls. In lieu of a tour through a highly automated plant, the conferences featured liberal use of visual aids such as color slides, miniature exhibits, and scale demonstration models which showed automation equipment.

The success of the meetings is indicated by a total attendance of more than 500 top-level representatives from 300 industrial concerns in the area. Evidence of their high interest was shown in the exceptionally fine returns from the bulletin bar wherein 326 requests were made for 3,202 bulletins and 1,191 copies of speeches. Two-hundred and ninety guests took the time and trouble to submit their written comments regarding the forums. Typical remarks were: "Very informative on a growing field—more forums are needed."

Good Press Coverage

Newspapers in the area gave the meetings excellent coverage and wide publicity. At last the company had managed to get before the lay public the spirit of automation as we see it. **"The Morning Call,"** Allentown, headlined one story with "Automation Hikes Output, Boosts Labor, Executives Agree at Allentown Parley." The story pointed up how in the next ten years industrial production is expected to expand by 47% although the working force will grow by only about 4% and will work a shorter week. The story said that this increased production will have to be achieved through automatic machinery and automated processes.

H. M. Schelden, vice-president of PP&L's Lehigh division, was quoted after he cited the experience of a company that was told 38 years ago the only way to avoid bankruptcy was to buy labor-saving machinery that would cut the costs of supporting a work force of 200.

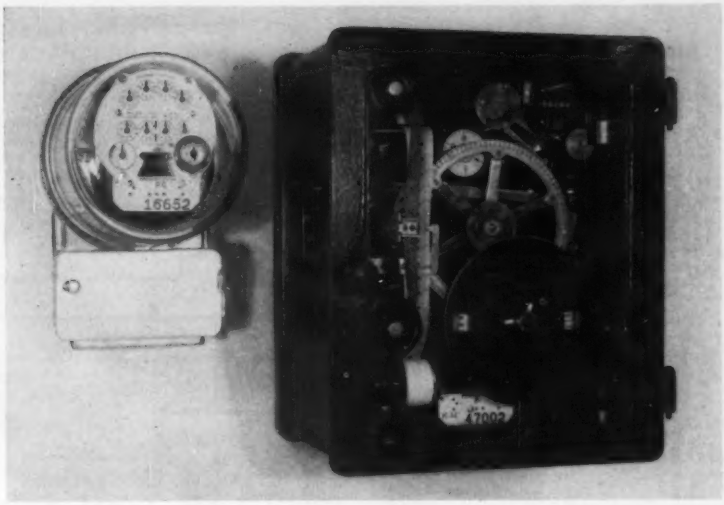
"For 38 years," the newspaper quoted Schelden, "they have been buying all the labor-saving machinery they could get their hands on in order to get rid of those 200 workers, yet today their employment is 25,000."

Summing up, company executives feel that automation activities enabled PP&L to get the right story to the right people in an effective and interesting manner. Their interest and comment was most favorable. There is every indication that meetings such as herein described, which are typical of those the company has been using for many years in our industrial, commercial and residential promotions, bring about an ever-closer relationship with our customers and open the way to greater electrification of industry to the mutual benefit of the industrialist and PP&L.

BECAUSE AUTOMATION THRIVES UPON A GOOD POWER DISTRIBUTION SYSTEM, EXHIBITS LIKE THIS WERE SHOWN

Con Ed Simplifies Metering

. . . By replacing recording demand meters (right) with cumulative type (left)



C. V. MOREY, Meter Engineer, Consolidated Edison Co of N .Y., Inc, New York, N. Y.

Replacing recording-type demand meters on large accounts with indicating demand registers of the cumulative type is saving Consolidated Edison Co about $250,000 per year in clerical and maintenance charges. Labor cost for making the replacements from 1951-1955 totaled $10,000. Adjustment for new loads added since the change in practice would boost annual savings in clerical and maintenance labor to about $300,000. These operating savings will continue and increase as new business is added.

The cumulative register is a standard indicating demand register equipped with two sets of dials, one of which cumulates kilowatt-hours, and the other, kw demands. Changing to these cumulative demand registers enables large accounts to be routed with all other meters for routine reading by the billing and meter reading group. Up to 1951, recording demand meters of the printed tape type, together with a few of the chart type, had been used for the measurement of demands in excess of 400 kw. These recording demand meters had been read as well as maintained by the meter maintenance group, and the billing data were transmitted to the billing and meter reading group.

No off-peak demand billing is involved in any of Con Edison's demand meter installations. And a demand-time record is mandatory for only a few special cases. A survey in 1951 of the 888 printing and graphic type demand meters on the system for installations where demand-time records were not required disclosed 642 in service on demands under 1,000 kw, 200 from 1,000 to 3,000 kw, and 46 above 3,000 kw.

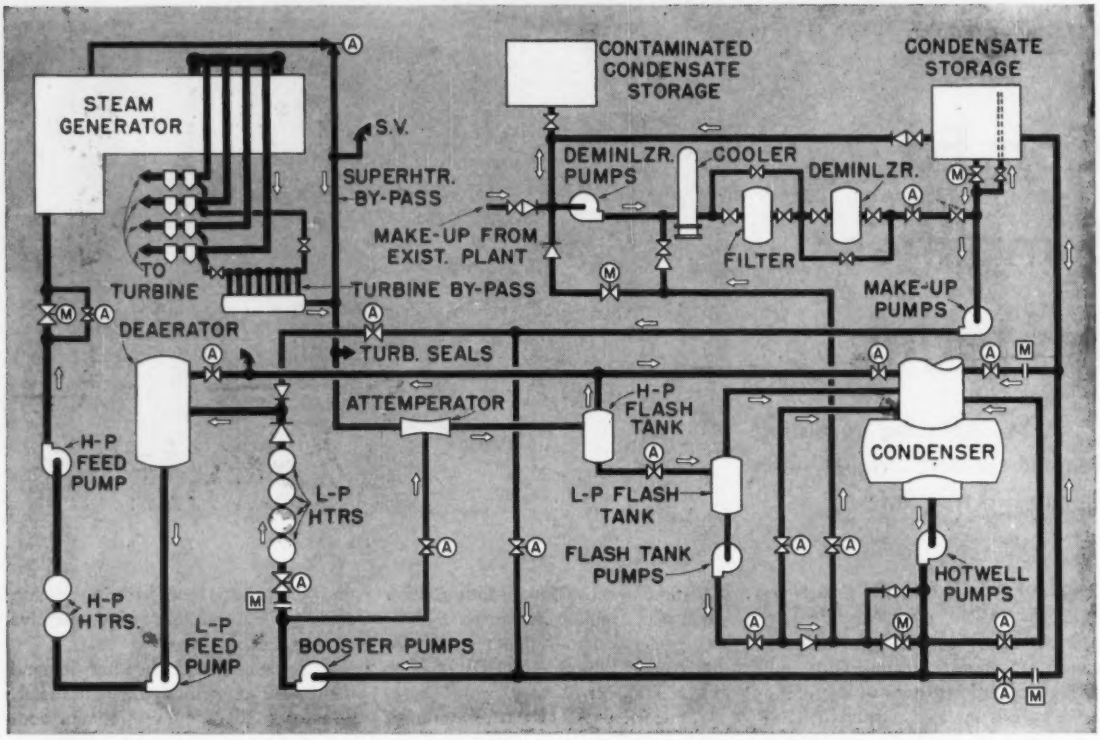
A special problem was encountered for installations having both high-tension and low-tension service. Such installations had been metered by two recording demand meters, one measuring the combined demand, and the other either the low-tension or high-tension separately. It was necessary to change the method of determining the HT and LT components of coincident demand to make demand registers applicable to these installations. Under the new method, three cumulative demand registers are used; one for HT, one for LT, and one for coincident HT-LT. The maximum coincident HT-LT demand is allocated to high tension in the ratio HT/(HT + LT) and the remainder is allocated to low tension. The new method affected bills of customers by very minor amounts.

Customers Cooperate

Each customer was notified before his demand meter was changed because of the possibility that some might be using the visual indication on the chart or tape to regulate manually their maximum demand. Only a relatively small number of customers objected. In a few cases, the customer accepted the company's offer to sell him the recording demand meter in place provided he installed an insulating relay to which a demand impulse circuit from the watthour meter could be connected. The customer then read and maintained the printing meter, and Con Edison used its cumulative register for billing.

The cumulative indicating demand meter, like the printing demand meter, is actuated by impulses from a contact device in the watthour meter. A simple procedure was adopted to determine whether the cumulative demand meters had received the correct number of impulses and to point up abnormal demands. Kwhr registers on cumulative demand meters are read for demands in excess of 400 kw. Comparing kwhrs shown by the demand meter with kwhrs shown by the associated watthour meters provides the necessary check on impulse circuits. Present kw and kwhr data are compared with past records for detection of abnormal demands. This procedure replaces the accuracy check previously provided by the tape of the printing meter. Remedial measures can be taken promptly.

The program called for replacement with cumulative indicating demand meters of recording demand meters in all cases where a demand-time record was not required and where the demand did not exceed 3,000 kw. This program has been accomplished in two successive steps: first, on loads of 400 to 1,000-kw demand and then, because operating experience following step one had been satisfactory, on loads between 1,000 and 3,000-kw demand. The 3,000-kw maximum was adopted somewhat arbitrarily and may be revised later. But contracts require chart or tape records on 130 of under 200 recording meters left in service.



Chemistry Influences Philo Design

GENERATION
Design

Properties of water for supercritical plant determine design features and materials, validated by pilot unit, other tests

E. B. MORRIS, Chemical Engineering Section Head, American Gas & Electric Service Corp, New York, N. Y.
H. F. RUTH, Chief Chemist, Philo Plant, Ohio Power Co

The chemical properties of water for the Philo supercritical-pressure steam plant determined many design features and materials as well as provisions for its successful operation. Many design problems for which there were no existing solutions were worked out through test programs even when experience with water for subcritical plants was a sound basis for projecting supercritical conditions.

All test data, particularly pilot unit developments, substantiated the original feedwater specifications. Although it may disclose unanticipated problems, initial operation is being approached with confidence in their resolution.

The role of chemistry loomed following the 1953 announcement that American Gas & Electric Service Corp, Babcock & Wilcox Co, and General Electric Co would jointly design and build this first commercial supercritical-pressure unit. Features of the 4,500-psi, 1,150F, two-stage reheat unit of 125-Mw capacity at the Philo plant of Ohio Power Co are described in the following:

1. "A New Power Generation Milestone," Philip Sporn, EW, June 29, 1953.

2. "Developing the First Commercial Supercritical Steam Generator," W. H. Rowand, Power, Sept. 1954.

3. "First Commercial Supercritical Pressure Steam-Electric Generating Unit for Philo Plant," S.N. Fiala, ASME Paper No. 55-A-137, November 1955.

4. "First Commercial Supercritical Pressure Steam Generator for Philo Plant," W. H. Rowand and A. M. Frendberg, ASME Paper No. 55-A-135, November 1955.

5. "First Commercial Supercritical Pressure Steam Turbine for Philo Plant," C. W. Elston and R. Sheppard, ASME Paper No. 55-A-159, November 1955.

Feedwater Specifications Drawn Up

In 1953, it was recognized that many considerations for subcritical water control would not apply, also that there were many totally blank areas of information on the behavior of water in the supercritical region. Nevertheless these feedwater specifications were drawn up:

Total dissolved solids	500 parts per billion max.
Silica (SiO_2)	20 ppb max.
Iron (Fe)	10 ppb max.
Copper (Cu)	10 ppb max.
Dissolved oxygen (O_2)	5 ppb max.
pH value	9.5 to 9.6.

First hand study of once-through subcritical boiler operation in Germany in 1954 produced no reason for changing the specifications. But what was most important were the data developed by B&W's pilot supercritical pressure unit at their Alliance, Ohio, Research Center. These findings further confirmed the validity of the original feedwater control conditions specified.

In developing adequate concepts for handling potential water problems, the designers recognized that many compromises would be required between what was considered ideal and what was reasonable for commercial operation. In this light the history and philosophy of the various considerations are reviewed here.

Turbine Needs Low Solid Content

Dissolved solids entering the once-through steam generator must be maintained as low as possible as it is to be expected that such salts either will be deposited or carried through to the turbine. Were high inlet solids passed through the steam generator without deposition, turbine deposition could produce its well-known effects. German experience with once-through operation substantiates the view that high feedwater solids generally cause a turbine rather than a boiler problem.

G. W. Morey and J. M. Hesselgesser give some idea of the solubility of such salts as sodium chloride and sodium sulfate. In "The Solubility of Some Minerals in Superheated Steam at High Pressure" (Journal of Economic Geology, Vol 46, 1951), they indicate appreciable values for the supercritical fluid. These investigators found calcium sulfate significantly soluble at 15,000 psi and 932F. Yet it appeared more realistic to assume that significant amounts of calcium salts entering the cycle, as happens through condenser leakage, would tend to deposit in the steam generator. Such deposition from retrograde solubility characteristics would probably occur below the critical temperature zone.

AG&E System experience over many years shows that at operating pressures up to 2,500 psi, feedwater is readily obtainable with solids in the 300 to 500-ppb range. Although even lower solids are feasible with present apparatus for demineralization, the designers decided to specify 500 ppb maximum solids. Furthermore they decided that condensate from existing units would be employed for cycle make-up to the supercritical unit. Demineralization equipment for operation on a bypass basis was incorporated in the cycle design to control the solids content.

The condenser was designed to eliminate leakage into the cycle as much as practicable. Besides corrosion-resistant materials, its design included sprayed rubber coatings over the tube rolls and sheets to stop seepage leaks. The designers nevertheless were aware that even these precautions would not be enough in the event of a condenser tube failure. Such a failure would necessitate shutting down the unit immediately as the extremely high river water solids could not be handled by full-flow demineralization except for a short time.

Generator Deposition Negligible

According to experimental data, silica having an extremely high solubility in the supercritical area, poses no problem of deposition within the steam generator. E. A. Pirsh and E. J. Wagner, Jr, indicate the equilibrium concentration of silica in 2,000-psi steam to be about 0.02 ppm for 1 ppm of silica in the boiler water ("Selective Silica Carry-Over in Steam," ASME Paper 55-5A-19). As these conditions are common in present commercial units considered acceptable with regard to turbine deposition, 20 ppb maximum was selected as an operating value.

Metallic Pick-Up Considered

The control of corrosion within the steam generator is closely allied to the primary consideration of "pure" water, the chemical aggressiveness of water increasing with purity, especially at high temperatures. One publication gave a solubility value of 90 ppm for ferric oxide at 15,000 psi and 932F. But the designers believed it more practical to consider the formation of a protective iron oxide film resulting from the fundamental iron-water reaction and the beneficial effects of alkalinity on such an oxide film. This consideration resulted in selection of a pH value of 9.5 to 9.6 to be achieved by ammonia or one of the suitable volatile amines.

This choice was subsequently confirmed by experience with a pilot supercritical unit. For the commercial unit, operating at a temperature interval of 525 to 1,150F between inlet and outlet, Rowand and Frendberg described materials of construction ranging from carbon steel through carbon moly and a series of chrome-ferritic alloys to austenitic material. The austenitic is only 10% of the total, the carbon steel 38%.

Minimizing corrosion and metallic pick-up from the pre-boiler cycle which, generally speaking, resembles the conventional subcritical cycle, is of parallel importance. For iron and copper a value of 10 ppb was initially selected as the upper limit to preclude excessive deposition of these metals within the steam generator. These values, although selected arbitrarily, were proved realistic and necessary by long runs of the pilot unit and tests on conventional cycles.

Volatile chemicals for pH control satisfactorily reduce metal pick-up of ferrous materials. With non-ferrous alloys, such as copper, they are considerably less effective. In view of the chemical characteristics of the volatile additives, 70-30 cupronickel was initially selected as the material for condenser and feedwater tubing. Subsequent results obtained from a small test condenser operating under the same pH conditions and with several alloys have established the validity of this selection with respect to copper pick-up.

Tests Check Iron, Copper Pick-Up

Comprehensive tests are being conducted to evaluate iron and copper pick-up in a 2,000-psi cycle under various pH conditions and with various additives. Test data tentatively indicate that desirable low levels of iron and copper can be readily achieved.

Table I conveys the order of magnitude of the surfaces and type materials exposed to steam and water throughout the cycle. It should be noted that for the condensate-feedwater cycle the ratio of non-ferrous to ferrous surface exposed to water is 1.5. For surfaces exposed principally to condensing steam, the ratio is 5.8, and for the entire cycle, excluding the turbine, it is 0.6. Other volume-surface relationships can be noted.

The role of dissolved oxygen in the corrosion mechanism has long been established. In accordance with conventional practice mechanical deaeration of feedwater to the lowest practicable level has been incorporated in the

TABLE 1 — PHILO UNIT 6 CYCLE

	Surface — Sq. ft.			Surface Ratio	Volume
	Ferrous	Non-Ferrous	Total	Non Fe/Fe	Cu. Ft.
Main and Reheat Steam (Excluding Turbine)	62,000	—	62,000	—	5,700
Condensate-Feedwater	9,000	14,000	23,000	1.5	2,200
Bleed Steam (Including Condenser)	12,000	70,000	82,000	5.8	20,000
Steam Generator	66,000	—	66,000	—	1,300
Total	149,000	84,000	233,000	0.6	29,200

unit design. In addition, the condensate cycle equipment has been designed to minimize the in-leakage of air. Expected maximum values for dissolved oxygen are 20 and 5 ppb, respectively, for condensate and feedwater.

Hydrazine was considered as an oxygen scavenger. A final decision will depend on current tests.

Multi-Purpose Equipment Designed

The engineering criteria for selecting water specifications and construction materials were applied also to the choice of auxiliary equipment for chemical functions. The chemical feed system was designed for the greatest possible versatility. Essentially it consists of two stainless steel tanks and three pumps, the third pump being a spare. Piping is arranged so that two separate feeds may discharge normally to the feedwater at the deaerator outlet. Equipment for pH and conductivity control provide that either of these characteristics may govern the speed of the pumps electronically.

This equipment was designed for multi-purpose use to accomplish the following:

1. Pre-operating cycle clean-up.
2. Bypass condensate clean-up during operation.
3. Solids removal during transient start-up and shutdown of steam generator.
4. Polishing of condensate make-up to cycle.

The dual unit filter and demineralizer equipment has a capacity of 100,000 lb per hr, equivalent to about 20% of condensate flow with filters and demineralizers connected for separate or combined use, whichever is desired.

Filters were originally specified to protect the demineralizer resin against fouling from iron oxide. As nothing was known about iron oxide filtration at these levels, tests were made at Philo on plant condensate before selection of type equipment and filter media. Of the various materials tested, cation resin and cellulose media gave the best results. Reduction in iron content from the 100 to 200-ppb range to 1 ppb was obtained. Lower initial levels were similarly reduced below 1 ppb.

As cation resin requires acid treatment for clean-up, attention concentrated on a renewable cartridge type of cellulose filter and a membrane type employing a cellulose filter aid. On an overall basis the latter was selected.

The leaching of organic material from the demineralizer resins was explored in the laboratory. Although it was found to occur continuously in trace amounts, more than two years' experience with the Alliance pilot unit showed no adverse effect. The selected demineralizers are of the mixed-bed type, designed for manual regeneration as continuous runs are expected to be lengthy.

Guard Against Contamination

The external recirculating system for starting up and shutting down is described by Fiala. As any salts and oxides deposited within the generator may wash out during these transient periods, it is desirable to avoid contamination of the entire cycle. Accordingly provisions were made for purifying the condensate from the flash tank system before it is returned to the cycle. Suitable arrangement of the filter-demineralizer equipment, a contaminated-water storage tank and appropriate interlocking controls, shown in the illustration, does this. Condensate is either returned to the cycle after passing through the demineralizer or is sent to contaminated-water storage in which event condensate is made up to the cycle from the main storage.

Chemical equipment is designed to be used in cleaning the steam generator, the high-pressure heaters, and the condenser. Its primary function is to serve for any operations required in the future, rather than for pre-operating cleaning, but it will also be used in the latter.

Sampling Points Provided

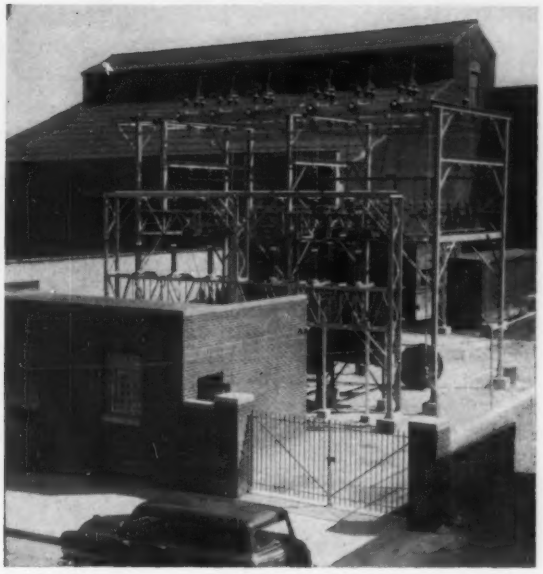
The following sample points are provided for monitoring and controlling steam-water conditions continuously:

1. Steam generator inlet.
2. Primary superheater inlet.
3. Primary superheater outlet.
4. Platen superheater inlet.
5. Secondary superheater inlet.
6. Secondary superheater outlet.
7. Condensate.
8. Deaerator discharge.
9. Flash tank drains.
10. Demineralizer effluent.

All samples are conducted through stainless steel tubing to stainless steel dual heat transfer coils in a central sampling room. Orifices at the coil outlets control the flow of steam generator samples. Each of sample points

(*Continued on page* 198)

From Terminal Poles on Street . . .



to Structure in Station Yard . . .

Rubber Cable Feeds 34.5-kv Sub

DISTRIBUTION
Design

Pennsylvania Electric Co installs oil-base insulation for supply cables to new substation to reinforce Erie's downtown network

R. P. AGER and J. A. SELVAGGI, Distribution Engineers, Pennsylvania Electric Co, Erie, Pa.

Oil-base-rubber-insulated 34.5-kv cable has been used by Pennsylvania Electric Co to supply its new Central-Erie Substation. This 20,000-kva installation has been built within 200 ft of Erie's main street to back up the 12-kv feeder system for the secondary network. It also reinforces the 12-kv supply for industrial loads in the area.

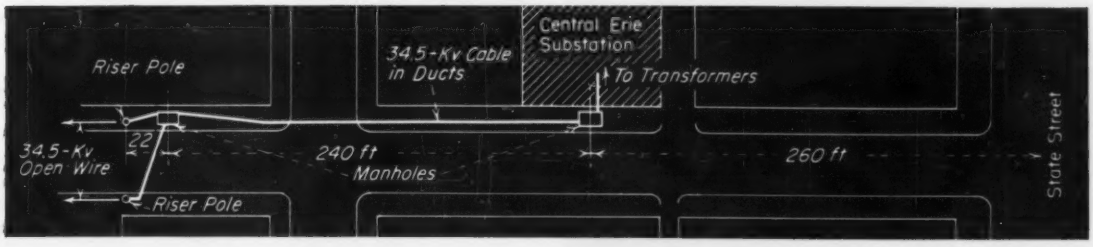
Selection of a site for this substation suitable for economical connection to existing 12-kv cables precluded overhead line for the entire 34.5-kv supply. Open wire could be placed on poles lining both sides of a side street for most of the distance, but congestion along the last 262 ft required underground cable.

The cable selected for this 34.5-kv connection is single-conductor 600 Mcm, insulated with oil-base rubber, shielded, and jacketed with Neoprene. Such cable is easy to install and is spliced much like 15-kv shielded rubber cable. Using it eliminates the oil migration, sheath cracking, and grounding problems of paper-lead cable and the pressure systems of gas-filled cable.

Ducts for this cable are of nonmetallic pipe, part buried in the earth and part encased in concrete. They originate in the substation yard, drop under the control house to a manhole in the sidewalk, then extend 240 ft along the street to the second manhole. Here they split and 3 ducts encased in 12 x 24-in. concrete run to each terminal pole.

The concrete envelopes extend 5 ft up each pole. The next 30 ft above this level has exposed aluminum ducts with woven-wire grips supporting each cable where it emerges at the upper end. From this point to the single-conductor potheads mounted beneath the open-wire deadends, the cable is supported by wood clamps mounted on crossarms. The potheads themselves and the adjacent lightning

(*Continued on page* 199)



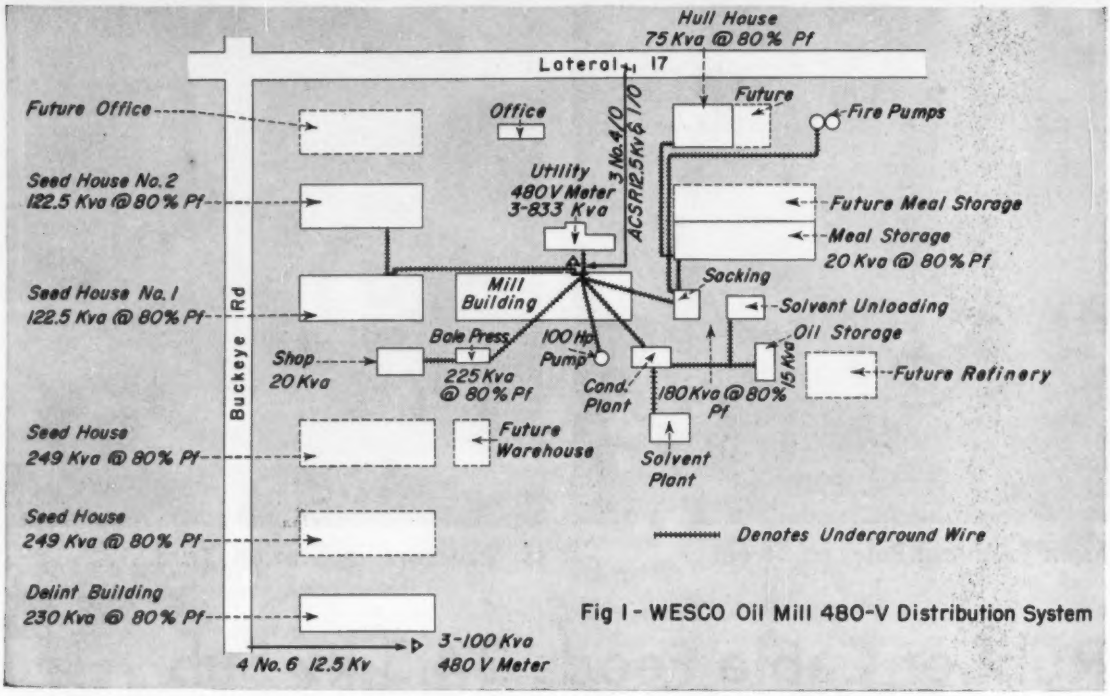


Fig 1 - WESCO Oil Mill 480-V Distribution System

12,500-V Primary Distribution System

A vigorous cotton products company suddenly realized its Phoenix oil plant had been expanded to 2½ times design size. Low voltage burned out motors and invited shutdowns. A new primary system solved these problems and now saves the plant $1,500 a year . . .

E. B. TUCKER, Industrial Consultant, Arizona Public Service Co, Phoenix, Ariz.

A high-voltage plant distribution system has ended shutdowns caused by motor burnouts at Western Cotton Product Co's Oil Mill, Phoenix, Ariz. Furthermore, the 12,500-v primary distribution system has eliminated hazardous electrical conditions and now is saving the company $1,500 a year.

This cotton oil mill has a three-fold purpose: It removes and bales all cotton lint remaining on the seed after the ginning process. This lint cotton is used in the manufacture of ammunition and mattresses. The mill also extracts cotton oil from the seed. This is the second and most important process performed at the mill. The plant also produces cotton seed meal and seed hulls for cattle feed.

Because this plant had expanded to 2½ times its ultimate design size, the original 480-v electrical distribution system was overloaded. Hazardous conditions prevailed in many places. This was especially true at the main 480-v switchboard in the mill building. This board controlled practically the entire plant.

Power for the entire operation was measured through

THREE 167-KVA transformers on the 12.5-kv system serve a meal storage and sacking area, even though load is 275 kva. The transformers were selected with an eye to the future

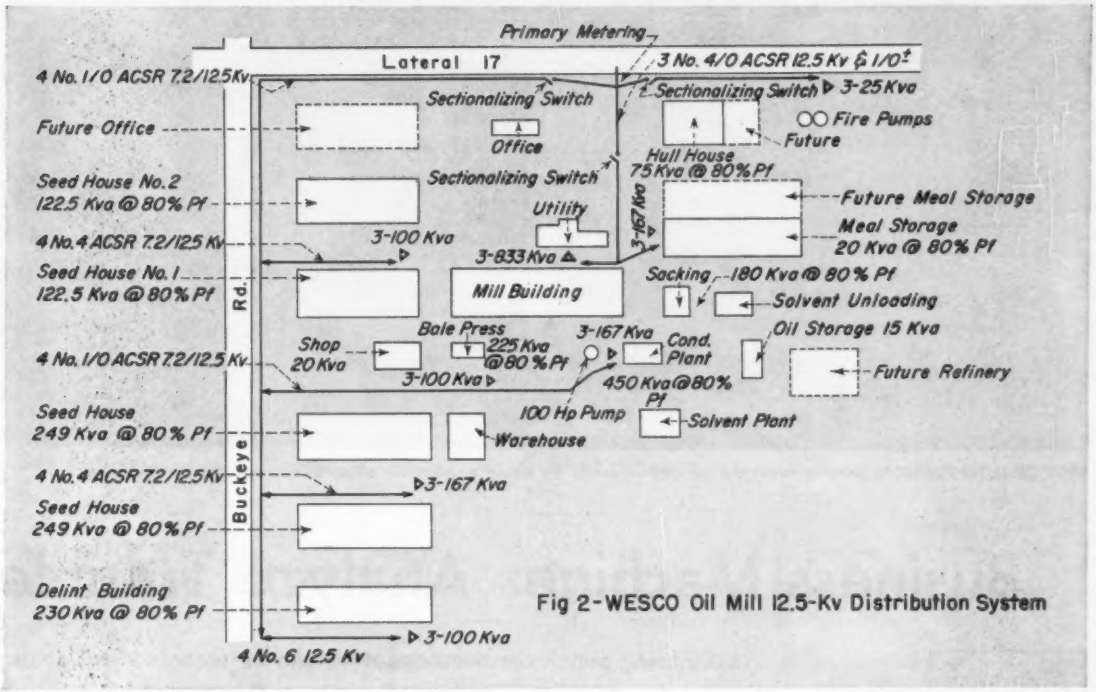


Fig 2-WESCO Oil Mill 12.5-Kv Distribution System

Ends Cotton Mill Shutdowns

two meters as shown in Fig 1. The sketch also shows the underground 480-v feeders from the main panel to the various processing points and their loads.

As the company was planning some new buildings with considerable load and also had some proposed processes for the future with very large loads, a recommendation was made to the company that a 12,500-v primary distribution system be installed. Power would be measured through one meter at the plant property line.

This idea appealed to the mill people, and a primary system was designed with consideration given to the future loads, construction sites, and relieving the main mill board of overload.

Through arrangements made with Arizona Public Service Co, the mill bought the bank of three 833-kva transformers and its primary feeder at the main mill building, and the bank of three 100-kva transformers and primary feeder at the delint building. Both of these primary feeders carried 12,500 v, and the transformers delivered 480 v.

The oil mill let a contract to a local electrical concern for the construction of the primary system and necessary transformer structures. The cotton company itself purchased the transformers for their existing and proposed future loads. Fig 2 shows the primary system as it was installed and the transformer locations.

The new transformer structures are all of the 2-pole, platform type, with the exception of the one pump location. Because of the small size transformers, a pole-mounted installation was selected. From all of the 480-v busses at the transformer installations, feeders are taken underground to the various load centers.

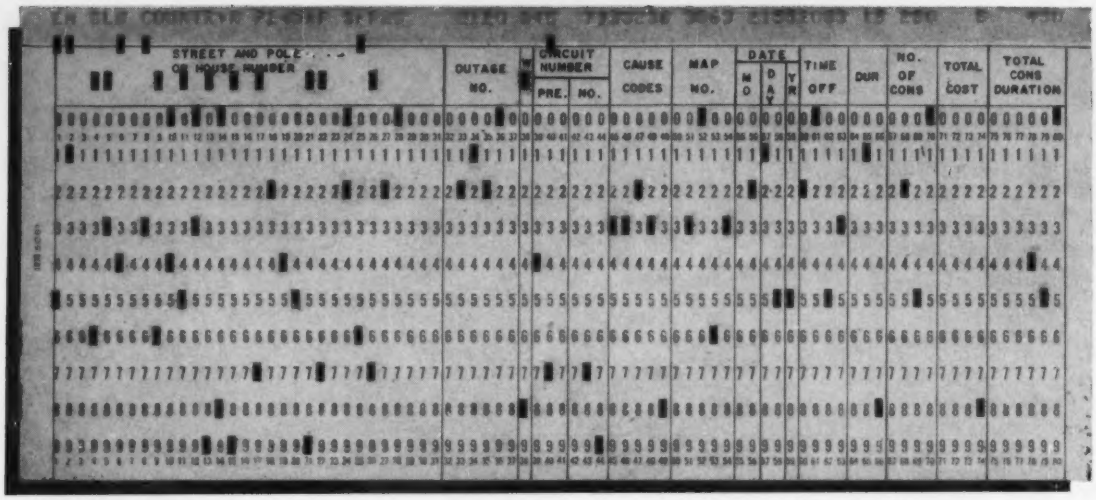
The Wesco Oil Mill is in operation 24 hr a day, practically all year long. Its total maximum demand is about 3,000 kw. Shutdowns occur only for maintenance or emergencies.

The mill people have been very well satisfied with the new primary system. Costly shutdowns, because of burned out motors due to low voltage and other reasons, have virtually been eliminated. The mill also realized a savings in power costs of $1,500 a year by measuring all power with one meter instead of two. This saving easily offsets the transformer and transmission losses of the primary system.

Still a third factor in favor of the high voltage system, also a money-saving advantage, is the versatility and economy involved in extending the system to new points of load and production.

A point worth mentioning also is that the system made possible for the first time, a practical and easy method of metering the power utilized in the various sections of the operation. For accounting purposes, this was quite an aid to the cotton company.

These primary distribution system advantages definitely have been proven to date. Their benefits will accrue even more with completion of future plans.



SERVICE INTERRUPTION data is recorded on punch cards by using accounting office business machine equipment

Business Machines Analyze Trouble

DISTRIBUTION
Design

By using punch cards outage data can be recorded and at any time sorted into various categories. This sorted information can then be printed for use by operating and planning engineers

J. McDOUGALL, General Engineer, Distribution Design Section, Long Island Lighting Co, Hicksville, New York

Recording and analyzing service interruption data with accounting office business machines is superior to any method used previously by Long Island Lighting Co. Information can be secured with greater speed and less clerical time. No extra equipment is needed because the standard accounting machines are used.

Trial operation of more than a year in one of the company's service districts which includes approximately 50% of the consumers on the system and subsequent analysis of the data confirm that business machine method will provide complete, accurate, and readily accessible records.

Fact that this method makes available information which was previously unobtainable is a factor which greatly favored its adoption. Cost of service restoration had always been entered under blanket accounts, and accurate information concerning expenditures for restoring electric service and relative cost of different types of interruptions could not be had. Much information which was included in the files could not be sorted in all desirable ways because of excessive amounts of clerical work required. Even more important, however, are reductions in labor for collecting, filing, and sorting information formerly done by hand.

While the recording and analyzing of interruption data by machine methods was begun to accumulate operating and maintenance cost figures, it soon became apparent that the data could be used for many other purposes. These additional uses can be grouped into four categories:

1. To analyze interruptions to determine what line maintenance should be stressed.

2. To analyze interruptions to determine where design practices should be improved or changed.

3. To check service continuity as an aid in preparing answers to consumer, civic group, local government, or Public Service Commission complaints.

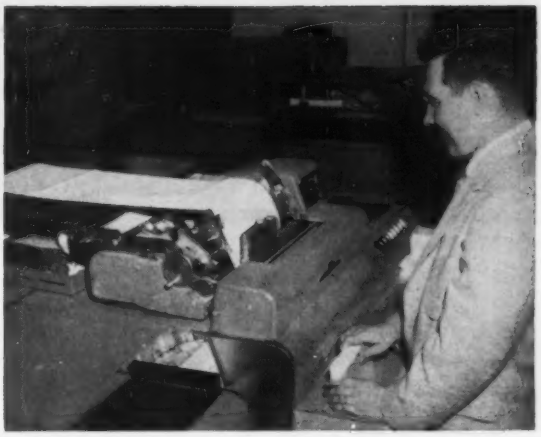
4. To gather information quickly for special studies or reports.

Another practical use for this data was found when a check of interruptions due to lightning by geographic location revealed several areas where repetitive outages had occurred. Subsequent tests indicated that most of these repetitive outages were due to high ground resistance. Steps were then taken to correct this condition. This type of analysis was impractical, previously, because of pro-

Table I—Approximately 72% of all consumer-hour outages on primary circuits in the trial area were due to four causes:

Cause	Percent of Total
Tree faults	47.8
Defective conductors, splices, and connectors	10.2
Slack wire	8.0
Squirrels	5.9
Total, four causes	71.9

CARDS CAN BE sorted as required for specific analysis



DATA OBTAINED from cards can be compiled on report form

Quickly and Cheaply for LILCO

hibitive amount of clerk time necessary for hand sorting and checking of files.

Major causes of interruption revealed by machine analysis were previously recognized. But specific relationship among interruptions, consumers affected, consumer hours lost, and cost to restore service were not known. It was discovered that more than 60% of all interruptions took place on secondary circuits; yet they accounted for only 9% of total consumer hours lost. This was largely because 64% of all secondary interruptions involved single consumers. They were caused by such things as loose connections at the meter block, service entrance, or service pole; defective service drop conductors or connections; and defective meters.

Cost of operating this business machine method is very low because:

1. Machines are used to perform much of the internal accounting in the company; therefore, no expenditure for equipment is necessary. Job is a minor one in routine of Mechanical Accounting Division. It is not done according to any rigid schedule and is absorbed into the work load of that section.
2. Service operators are already recording required data for manual filing.

Only major cost of operation is for clerk time involved in gathering, coding, and recording data prior to transmittal to Accounting Department. As more information for machine processing is accumulated, additional savings will be accomplished in the labor required for collecting, filing, and sorting information. Information now unobtainable because of excessive amount of labor required will become available. It is estimated that these savings will soon more than defray the cost of clerk time required to obtain them.

Method of gathering, classifying, and coding interruption data results in a minimum of errors or differences in judgment.

Data required on each interruption are divided into three general categories:

1. Geographic and "electric" location.
   - a. Street and pole and/or house number.
   - b. Primary distribution circuit number.
   - c. Electric facilities map number.
   - d. Tax district number.
2. Time of occurrence and duration.
   - a. Date.
   - b. Time of day.
   - c. Duration.
   - d. Outage number.
   - e. Consumer duration.
3. Cause and effect.
   - a. Interruption codes.
   - b. Weather.
   - c. Number of consumers affected.
   - d. Cost of service restoration.

Interruption codes are used to conserve space on punch card. They describe cause and effect of interruption as

Table II—Approximately 82% of all consumer-hour outages on secondary circuits in the trial area were due to five causes:

Cause	Percent of Total
Transformer outage due to crossed secondary conductors	45.9
Transformer outage due to overload, not including burnouts	13.6
Defective meters, conductors, splices, and connectors	8.7
Transformer outages due to faulted consumers' equipment	8.5
Transformer burnouts due to overload	5.3
Total, five causes	82.0

LILCO—ELECTRIC INTERRUPTION REPORT

LOCATION / EFFECT	CAUSE	OUTAGE NUMBER	W	CIRCUIT PRE.	CIRCUIT NO.	INTRPTN. CODES	MAP NUMBER	DATE M	DATE D	DATE Y	TIME OFF HR.	TIME OFF MIN.	DUR. HOURS	NO. OF CONS.	COST $	CONS. DUR. CONS.-HRS.
WILLIAM S P9	P9	789	P	68L	129	25235	3212	7	06	4	9	14	1.0	15	11	150
BEARINGTOWN R P153	P149	979	0	48	117	25235	1429	7	31	4	17	02	1.3	15	4	195
COTTEN L P8	P5	993		68L	128	25235	2368	7	31	4	15	02	.6	25	4	150
WASHINGTON A P333	P33[illegible]	[illegible]81	W	SU	100	25235	[illegible]516	11	29	4	[illegible]			10	4	140
WILLIAM S P9	P12	1776	W	68L	129	25235	3220	11	29	4	15	44	.8	15	2	120
* WEATHER CODE																

REPORT FORM column headings closely follow those of punch cards. Actual size of form is about 11 in. by 14 in.

well as give circuit voltage class. For example, the number 25235, taking up five columns on the card, would represent the following:

2—On 13.2-kv distribution.

52—CSP breaker tripped due to.

35—Crossed secondary conductors (not triplex).

Information on hurricanes and other major emergency periods has not been included because it lacked sufficient detail. However, new methods of recording information during periods of extreme emergency will furnish data which are complete and accurate enough to warrant inclusion in the electric interruption file. Arrangements are now being made to have this material incorporated.

Same Form Used by Service Operator

Information is gathered by the service operators and office clerks. Service operator records, on basically the same form as used previously, the following information:

1. Consumer's name.
2. Street, pole and/or house number.
3. Municipality.
4. Date, time of occurrence, and duration.
5. Cause and effect.
6. Number of consumers affected.
7. Weather conditions.
8. Materials used.

If more than one service man is necessary to restore service or if help is required from line crews, substation operators, or distribution personnel, a notation to that effect is made. Each day a clerk takes forms filled out by service operators and using circuit maps, estimating data, and other references adds the additional information. This information is primary distribution circuit number, electric facilities (secondary) map number, outage number, and cost of restoration. When all necessary data is gathered, coded, and recorded, it is sent to the mechanical accounting section of the Accounting Department.

Headings on form transmitted to Accounting Department are set up in same order as those on punch card used to record these data, enabling key punch operator to prepare cards speedily and accurately. Punched cards are then verified and filed for future reference.

MACHINES NORMALLY used for accounting are used to transmit to punch cards data furnished by service operators

Speed Is An Important Advantage

The many ways in which data recorded on business machine cards may be sorted and the great speed with which it can be done are two of the factors which give this system its superiority. Electric interruption data may be sorted by one or more of column headings listed previously. It is therefore possible to prepare from one set of cards information for many purposes requiring a different sequence or grouping.

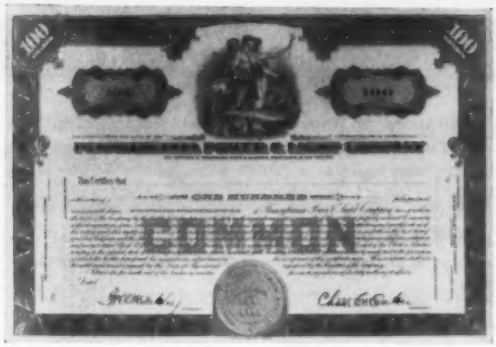
For instance, sorting machine can arrange the cards according to type of outage and in chronological order under each type. Another machine will take information from these cards and prepare a detailed printing of each outage or totals of different types depending on what information is desired. When this operation is complete, the cards may be fed back into sorter and rearranged, at a speed of 650 a minute, according to primary circuit number and a group or detailed printing performed. Possible number of ways in which cards may be rearranged is limited only by number of column headings on business machine punch cards.

Detailed listings most commonly used are:

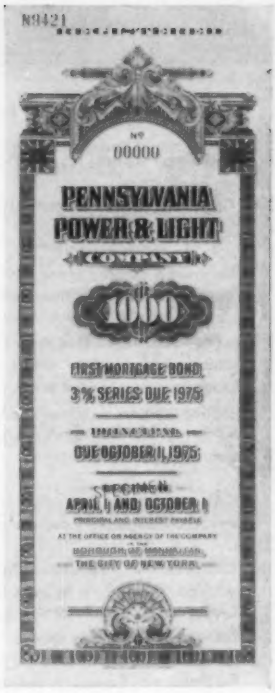
1. Outages by causes in chronological order.
2. Outages by primary circuit number in chronological order.
3. Outages by electric facilities map number in chronological order.

Copies of the most recent lists are now maintained in the distribution design section for immediate inspection. Other sortings and printing can be made on short notice.

Consideration is now being given to recording other functions of Electric Operating Department on business machine cards.



COMMON STOCK usually offers owner the greatest return on investment but has the most risk involved



BONDS give owner mortgage on company's property at a fixed interest rate; offers less return, least risk

PREFERRED STOCK usually offers owner more return on investment than bonds but less risk than common

A Special Report tells . . .

How a Utility Raises Funds

HERBERT R. FRANKEL, Financial Editor

If the electric utility industry is to make the tremendous planned expansion program of the next ten years a reality, it must first get the money. Utility managements are well aware of this. But other utility personnel rarely appreciate the complexities of "raising" money.

This is a distinct management problem. But while the responsibility for solving it must necessarily rest in the hands of the board, the president, and a few top executives and financial experts, all supervisors in the company should have an understanding of how it is done. How the money is raised has a great effect on the company and its future operation.

All electric companies (just as other well-organized business firms) have some cash on hand. No electric company has enough to finance a large expansion.

The first source of money is always the customers. But profits on sales to them are never enough. At present the average electric company can depend on its customers for roughly 25 to 32% of funds it needs. Remaining money, 75 to 68%, must be "raised" by borrowing (selling mortgage bonds and debentures) or by inducing people to buy into the company through stock purchases.

Let us assume an electric utility needs to undertake a project costing $47 million. How much money can the company contribute and how much will have to be raised from the sale of securities? Assuming 32%, or in round figures $15 million, can be accumulated by the utility from its own operations, then 68%, or $32 million, must be raised from security sales.

In terms of the financial expert, this $32 million is known as "new money" because the securities issued are not replacing ones which have matured or have been called for redemption.

How does a utility obtain "new money"? There are

FOLLOW "THE CAPITAL FINANCING ROAD" BEGINNING ON NEXT PAGE

GLOSSARY OF

Bank Loan: Short period loans at a fixed rate of interest.

Bidding Papers: An invitation to bid on securities to be issued.

Capitalization: Amount of bonds and stock (including surplus) of the company.

Common Stock: Stock with last claim upon assets and whose dividends vary with financial success of company.

Competitive Bid: A formal sealed tender or written notice in which an underwriter offers to purchase a particular bond or stock issue at a certain price.

Convertible Bond: A loan that may be exhanged for other securities of the company.

Coupon Bond: One which is payable to the bearer and carries detachable interest coupons also payable to the bearer.

Cumulative Preferred Stock: A form of preferred stock wherein the failure to pay the dividend at any regular time results in an accumulation of dividends until all payments in arrears can be made up.

Debenture Bond: A long-term loan obtained without any security other than the general assets and credit of the company and of its prospective earnings.

Due Diligence or Informational Meeting: Meeting held to permit underwriters to seek whatever additional information they may need in order to submit a bid for the security to be offered.

Expenditures: All expenditures which are incidental and necessary to the proper management and prosecution of company affairs.

First Mortgage Bond: A loan which has first claim against the pledged property.

Generated Cash: The amount left over from income after paying all operating costs, tax payments, interest on debt, dividend payments, and miscellaneous reservations of cash.

Mortgage Bond: A loan which is secured by the definite pledge of physical property valued considerably higher than the amount of the loan.

Mortgage Indenture: A document that defines and bounds all the company's property that will be pledged as collateral to secure the mortgage under which the bonds are issued, as well as other pertinent information, including depreciation and maintenance requirements; franchise limitations (as to date of their termination); sinking fund requirements, and "call" prices of bonds redeemed through their operation; certificates of earnings; certificates of fair value of pledged property by engineers;

certain standard procedures and channels through which this can be done. The utility may choose one or a combination of them. Its choice of method will depend upon a number of factors, some of them highly complex.

Disregarding some minor methods these are the usual channels for obtaining "new money:"

a. Bank loans (temporary).

b. Issuance of Bonds (mortgaging of property).

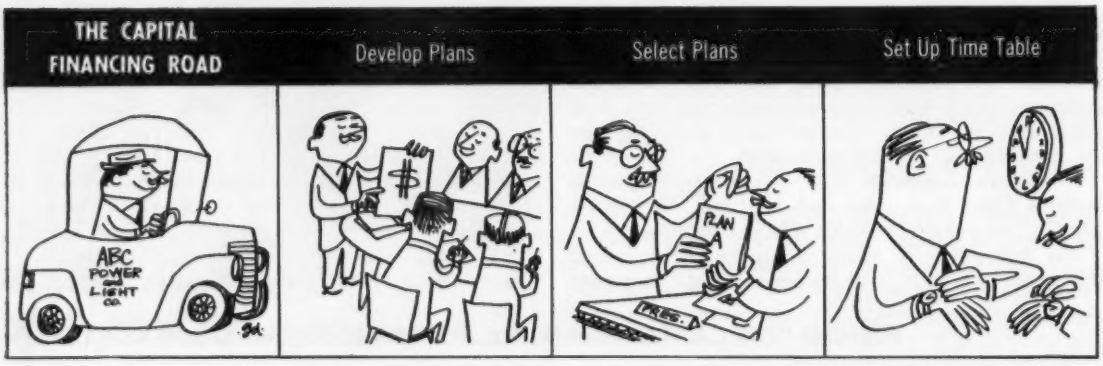
c. Issuance of debentures (long-term notes on the credit of the corporation).

d. Sale of preferred stocks.

e. Sale of common stocks.

Bank Loans . . . Bank loans are usually obtained for a short period, not exceeding a year or two. They are considered "temporary" because this money is obtained only until such time as funds can be obtained more advantageously from sources listed above. It must be remembered that the utility cannot wait until conditions are favorable for it to borrow money before it starts new construction. Therefore, if for certain reasons the utility decides that conditions are not favorable for issuing bonds or selling preferred or common stocks, it will borrow money from a bank or from a group of banks.

Bonds . . . The chief source of "new money" for utilities is the sale of mortgage bonds. There are different kinds, and various factors have to be considered before a decision is made as to the type that will be sold. Another decision that has to be made at this point is: How much of the money that is to be obtained must be through mortgage bonds. This and the various steps through which the utility



FINANCIAL TERMS

dividend restrictions; and default, what action or lack of action constitutes.

Negotiated Public Offering: Company sells issue to one or more underwriters. Company and underwriter agree on price the security is to be sold to the public.

New Money: Money required for the business over and above the amount left after all expenditures and dividend payments.

Offering Prospectus: The same as a "red herring" prospectus except that prices to the public and underwriters' terms are inserted.

Par Value of Stock: Usually the price set up by the corporation on its books for that stock.

Preferred Stock: One that has preference as to dividends and assets over the common stock, but not over the bond. It receives a stated dividend from profits after interest charges and before anything is allotted to the common stock.

Private Sale: The company selects an underwriter who contracts for a fee to sell the securities to institutional and other investors.

Receipts: The total gross income from operation of the property.

Red Herring Prospectus: A document prepared from the information contained in the registration statement which is available to all underwriters who may be interested.

Registered Bond: One upon which the name of the owner appears with the record kept by the issuer.

Registration Statement: A document filed with the Securities and Exchange Commission on a sale of a new security. This statement gives material facts about the company issuing the security.

Rights Offering: Permit to stockholders to subscribe proportionately to new issues of stock before the issue is offered.

Serial Bond: A loan of which a fixed portion becomes due and payable at regular intervals during the life of the issue.

Series Bond: A loan that is issued in different series under a single indenture.

Sinking Fund Bond: A loan requiring a special fund designed to provide full or partial redemption during the life of the indenture.

Sources of New Money: Normally, bonds and stocks.

must go in the sale of bonds will be discussed later.

Debentures . . . There are different types of debentures. They usually mature in about ten years.

Preferred Stocks . . . Some money can be obtained through the sale of preferred stocks if the company feels that this is best for its particular financial structure.

Common Stocks . . . Frequently common stock is sold, either to the public direct or through the issuance of "rights" to stockholders and to employees.

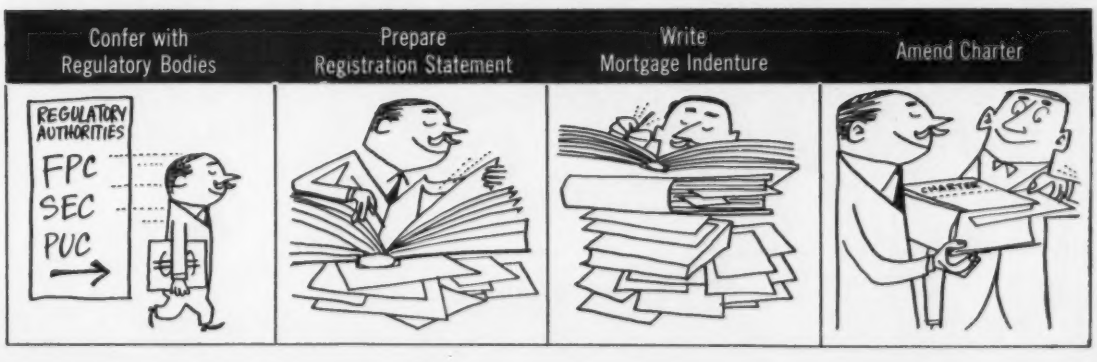
The factors that go into the decision of how much "new money" will be derived from bonds, how much from preferred, and how much from common are many and varied.

Without going into detail on the various factors, for the time being, it can be stated that, as a general rule of thumb, a company's "capitalization," that is its bonds, preferred and common stock, bears the ratios of approximately 50% bonds, 15% preferred, and 35% common (including surplus).

Now to return to the case of the electric utility mentioned earlier that has to raise $47 million for a new project. This $47 million would break down like this:

Cash generated internally	$15,000,000
Securities to be sold:	
Bonds	16,000,000
Preferred	6,000,000
Common	10,000,000
Total program	$47,000,000

Now let's see how the utility will obtain the $32 million.



Selling First Mortgage Bonds

• These bonds can be marketed in any one of three general ways: Competitive bidding; negotiated public offering, and private sale

By far the most complex procedure in raising new money is involved in the issuance of bonds. Let us therefore consider the steps required in the case of the $16 million of first mortgage bonds to be sold.

First, there are three general ways in which the issue can be marketed. One is known as "competitive bidding." In this case underwriters are invited to bid on the issue, and the award is made, usually, to the underwriter submitting the best bid. The second method is known as a "negotiated public offering." In this case the utility deals with one or more underwriters and negotiates with them instead of requesting bids. In both of these instances the bonds are purchased from the utility and resold to the general public. The third method is known as a "private sale" in which the company selects an underwriter to act as his agent to place the bonds with a few institutional investors, such as insurance companies and/or trust and pension funds. The underwriter does not purchase the bonds but receives a fee or commission for placing them.

There is some controversy as to which method is preferable, and each has its supporters. But competitive bidding is most frequently used method for marketing bonds and is made mandatory by many regulatory agencies.

On most days of the week you can find on the financial pages of your local newspaper, unspectacular advertisements under the name of this or that utility company. They are apt to start something like this:

"Always Benefit Customers Power & Light Co

PUBLIC INVITATION FOR BIDS FOR THE

PURCHASE OF $16,000,000 FIRST MORTGAGE

BONDS DUE MAY 1, 1986"

"Always Benefit Customers Power & Light Co, a Pennsylvania corporation, hereby invites sealed bids for the purchase as a whole of an issue of $16,000,000 First Mortgage Bonds due May 1, 1986 . . ."

Much work has preceded the placement of this ad. The services of a number of people have been involved, including lawyers, accountants, engineers, financial experts, and printers. A lot of paperwork, headwork, footwork, and bookwork has gone into the job. The invitation for bids is near the end of the trail, the time when the $16 million will become a reality in the form of cash.

For our purposes, the start on the trail to the $16 million first mortgage bonds due 1986 might be said to have been a meeting of the board of directors of the ABC utility company more than a month before the placement of the advertisement.

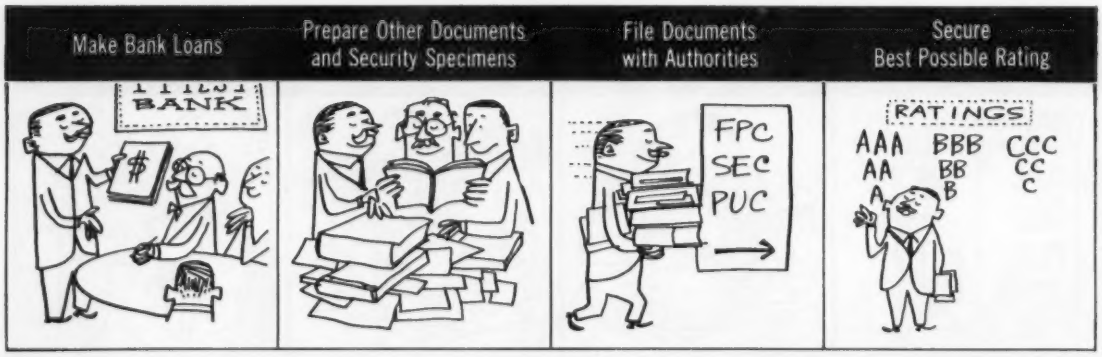
At this meeting the directors of the company gave their approval to seek the $16 million through the issuance of these bonds. This approval also carried with it the clearance to the financial executive of the company to file a "registration statement" with the Securities and Exchange Commission in Washington and to take whatever additional action is necessary to sell the bonds.

A Financing Time Table Is Set Up

This action calls for adherence to a time table which will have been set up by the utility's financial officer listing the dates when each step in the bond sale program should be accomplished. This will include clearing the plan with the necessary regulatory authorities. All new security issues aggregating over $300,000 must be cleared with SEC. If a utility comes under the jurisdiction of the Federal Power Commission, its approval must also be obtained. In many states the approval of the state regulatory authority is necessary.

Right here we see how complex doing business can be in an age of growing government regulation. A registration statement is required under the Securities and Exchange Act of 1934.

It is a factual statement of the company's current financial position. It also includes a recent statement of income and a general description of the securities proposed to be issued. This would include such things as the trustee under the indenture, the date of issuance and of the maturity of the bonds, when interest is payable,



Requires Most Complex Procedure

sinking and redemption fund provisions, and a description of the property upon which the mortgage constitutes a lien, as more fully described in the indenture (discussed later). It also includes "material facts" about the company's business.

It sets forth the amount ($16 million) and title of the securities to be registered (First Mortgage Bonds due in 1986), the proposed minimum offering price acceptable, and the amount of the SEC registration fee which will amount to $1,600 on this issue.

SEC Must Approve Statement

The utility can't proceed until this registration statement is made effective by SEC. But it is of interest to note that the statement carries the following notation on the cover:

> "These securities have not been approved or disapproved by the Securities and Exchange Commission nor has the commission passed upon the accuracy or adequacy of this registration statement. Any representation to the contrary is a criminal offense."

After the registration statement has been prepared, the company prepares a preliminary prospectus which is called a "red herring" prospectus. This description comes from a statement printed in red type on the front cover stating:

> "A registration statement relating to these securities has been filed with the Securities and Exchange Commission, but has not yet become effective. Information contained herein is subject to complement or amendment. These securities may not be sold nor may offers to buy be accepted prior to the time the registration statement becomes effective. This prospectus shall not constitute an offer to sell or the solicitation of an offer to buy in any state in which such offer or solicitation would be unlawful prior to registration or qualification under the securities laws thereof."

A copy of the "red herring" prospectus is given to all underwriters who may be expected to submit bids on the bonds.

The company also issues "bidding papers" which constitute an invitation to prospective purchasers to bid on the $16 million bond issue. Under this paper, prospective purchasers can examine copies of the Mortgage or Deed of Trust and such amendments to it as have previously been adopted including the one made necessary by issuance of the proposed additional bonds. The registration statement and the terms under which bids will be accepted (or rejected) is also included in the bidding paper, together with an attached form of bid for use of the prospective purchaser (underwriter).

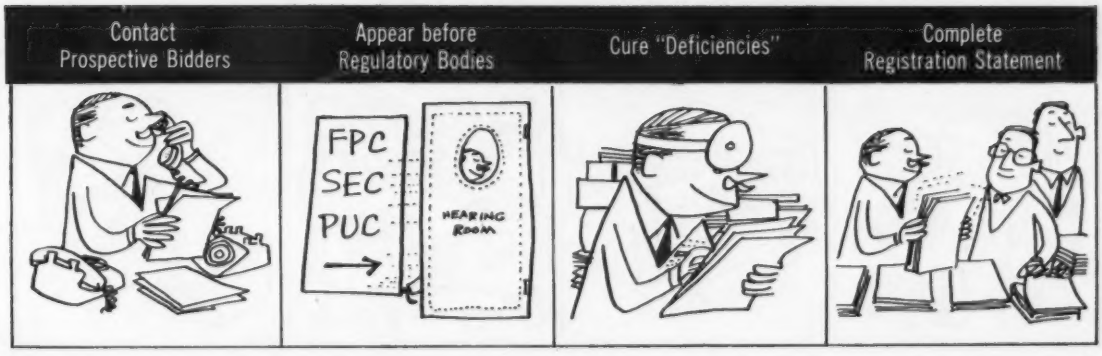
Another fairly complex document is prepared at about the time the registration statement is prepared. This is known as the "mortgage indenture". This includes a rather comprehensive statement of the company's property that is being pledged as collateral to secure the mortgage under which the bonds are issued. The indenture statement will not only go into the files of the SEC, as does the registration statement, but copies will be held by the trustee under the mortgage.

Originally at this point hearings were held by the SEC. Today inasmuch as most of the principles have been established, hearings are seldom held. However any interested party may file objections, and SEC itself may object. If there are any "deficiencies" (errors or omissions such as the withholding of a material fact), in the registration statement, these "deficiencies" must be "cured." Similar hearings may be conducted by other regulatory authorities having jurisdiction.

Good Rating Is Sought

So far, we have been concerned mainly with the preparation of certain highly essential documents. But there comes now a step in this process about which few people except the company's financial officers know. This step is not required by law, it is not compulsory for any other reason, but it is important to the company because it can have a bearing on the price that is offered for the bonds by the underwriter. This step is the series of conferences with investor service companies, commonly referred to as "the rating agencies."

The rating agencies are: Moody's Investors Service, Standard & Poor's Corp, and Fitch Investment Service. They study the financial situation of companies and then



On the need to know more about finance, RALPH BESSE, executive vice president, Cleveland Electric Illuminating Co, at a company management meeting said:

> "Everyone here ought to know something about accounting, taxation, depreciation, regulation, FINANCE, engineering, economy, industrial psychology, public relations, purchasing, and marketing."

proceed to rate their securities as to quality. They will decide that one company's bonds should have a top rating of Aaa, that another's warrant no better than A, and that a third rates still lower, or B. There are many possible ratings. Their significance to the company about to offer bonds to the public is this: The company with the Aaa rating will get a better price and a lower interest rate than the company rated B. So the B rating loses two ways. First, it doesn't get the same amount of money at the initial bond sale, as does the higher-rated company. Second, over the 30-year life of a bond it will have to pay out a good deal more in interest charges than the Aaa utility company.

Highest Rating Sought

There is, therefore, continual striving among utility companies to attain the qualities sought by rating agencies as essential for a high rating.

The ratings themselves are a method for providing the investor with a system of grading by which the relative investment quality of the bonds can be compared. Substantially they measure the degree of risk involved—those with the least risk of being rated highest.

The qualities considered embrace the relatively advantageous position of the enterprise as measured by its past financial history, quality of its management personnel, stability of current revenues, and load sources of its electric power both actual and potential, terms of power purchasing contracts with neighboring utilities, ratio which the amount of bonds outstanding and of those to be issued bear to the value of the plant account—both before and after depreciation, potential market for its services, extent of governmental encroachment, treatment accorded other condemnation proceedings, "times earned" of fixed charges both present and prospective, history of regulatory decisions, and other related information.

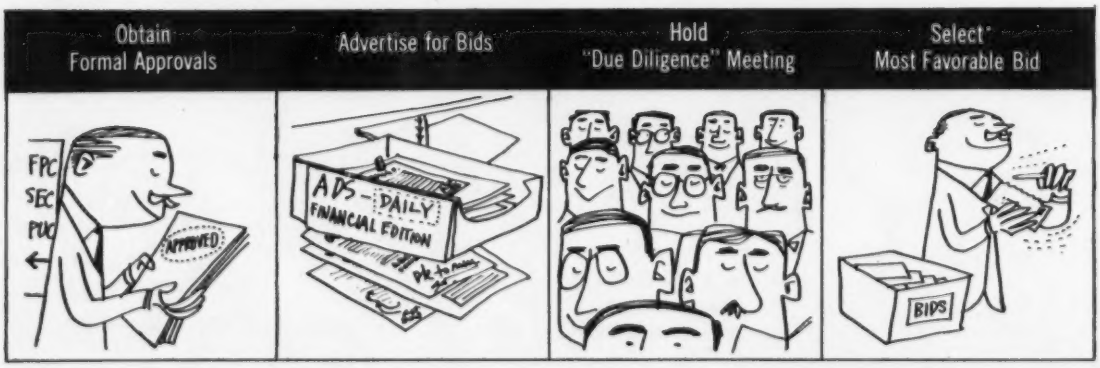
By now it is about time for the company to place the advertisement calling for bids on the bonds (along the lines shown above).

Actually, the advertisement is likely to be nothing more than a formality. All interested underwriters will long since have heard of the offering, will have qualified under SEC rules to become a bidder, and will have obtained copies of the "red herring" prospectus. The ad, thus, merely tells them the time, the place, and the date.

'Due Diligence' Meeting Held

There remains one important event before the receipt of bids for the bonds. This is a meeting known as the "due diligence" or informational meeting at which all potential underwriters will ask questions of the company officials. Few people know the origin of the term "due diligence". Actually it arises from the Securities Act which requires that "due diligence" must be exercised by the underwriter. As it happens, the "due diligence" meeting could more appropriately be known as the "bare the company soul" meeting.

Possible underwriters are likely to, and generally do, ask some extremely pointed questions at these meetings. They want to know from top management about the public power situation in the area; the regulatory climate, labor conditions, future construction programs, how much reserve capacity the company has, earnings and dividends prospects, and other pertinent facts about the company.



On the importance of financial training, HAROLD QUINTON, president, Southern California Edison Co; and former president of the Edison Electric Institute recently said:

> "While there is no halo around the financial officer, there is no substitute for training and experience in the handling of financial tools."

There is some drama attached to the submission of bids by the underwriters on a bond issue. The form of the bid sets forth the coupon rate and the price offered for the new bonds. The underwriter must enclose a check of about 3% of the principal amount of the bonds to be purchased. The form of the bid will have set the closing time around 11:30 AM Eastern Standard Time on a given morning for submission of the bids.

The Opening of Bids

On the dot of 11:30, the various sealed envelopes will be opened by the company officials. Usually some of the underwriters will be present. A quick calculation will be made of the various offers. Usually within a short period of time the company will announce the acceptance of the most advantageous bid, i.e., the one resulting in the lowest "cost of money" to the utility.

The same day that the underwriting bid is accepted, a contract will be signed with the underwriters. Following the acceptance of the underwriters' bid for the bonds, the directors of the company meet to approve the mortgage indenture and the execution and delivery of the underwriter's purchase contract.

The price set by the underwriters has to be cleared with the SEC. Upon clearance by SEC, the underwriters will start offering the bonds for sale to the public through the offering prospectus. This is merely the "red herring" prospectus with red type removed and the offering price and other related data inserted therein. Usually within a week, a "closing" takes place at which time the underwriting group will present the utility with a check for the balance due it, together with the distribution of all necessary documents among the parties involved.

Of course, sometimes the company may reject all bids because it feels it is not getting a satisfactory price for the security.

Now this all appears fairly routine, and to many it probably is. But look at what was involved in selling $16 million in first mortgage bonds. Our hypothetical utility may have paid out $20,000 in printing costs for the reproduction of the various documents. Lawyer's fees will have taken another $15,000. Registration fees and federal stamp issuance tax will take $19,000 and accounting services and other expenses will total another $20,000, or a total of approximately $75,000 for the job.

Many Hands Were Needed

In addition the operation will have taken much of the time of the chief executive officer, very nearly the full time of the chief financial officer of the company, a substantial portion of the time of several employees in the financial department, the time of several company lawyers, as well as outside legal, accounting, and printing services.

For the sake of simplification, the procedure just described has been confined to the most commonly used form—the first mortgage bond. But there are a number of different types of debt other than mortgage bonds, such as long term notes, debentures, convertible debentures, etc. Each has some characteristics, or quality, that might make it suitable for some special situation.

Now let's see how the ABC utility company sold its $6 million (60,000 shares $100 par value) in preferred stock and $10 million (1,000,000 shares $10 par value) of common stock.

Stock Selling Can Be Simplified

Some preliminary steps may be omitted from 'The Capital Financing Road', since private sales, 'rights' to stockholders, and employees offer ready markets

Our ABC utility now has $16 million in cash raised by the issuance of bonds. Its schedule calls for the $6 million to be obtained from preferred stock and $10 million from common stock. This will give the company the total of $32 million which it will need to meet the cost of constructing the $47 million project. The specified amount of each issue, as set out earlier, is designed to maintain capitalization ratios in accordance with sound financial practices.

In the normal course of events, a utility may make an offering on the same day of bonds and common stocks, bonds and preferred, or possibly preferred and common. For purposes of this article, however, we shall disregard this element.

The issuance of both preferred and common stocks sold to the public entails compliance with practically all the regulations applicable to bond sales. It is possible though to dispense with some of the preliminary steps that lead to the issuance of the stocks for these three reasons:

1. Preferred stocks often can be disposed of at private sale in blocks to insurance companies, mutual funds or other institutional investors.

2. Common stocks may be issued to present shareholders on "rights" which gives the stockholder the right to subscribe to additional shares.

3. Stock may be issued to employees under an "Employee Stock Purchasing Plan."

'Rights' Offering Explained

The main reason for a "rights" offering is that it is made mandatory by the charter provisions of many companies. A "rights" offering is a stock offering in which present holders are given first choice on new shares to be issued on some such basis as one new share for every ten shares presently held. In addition, there may be a price preference involved. That is, the new shares may be offered at a price slightly lower than the current market price of the old shares.

If there are any shares not subscribed to by the stockholders under a "rights" offering, they are usually sold directly to the public by an underwriter or a dealer-manager.

Occasionally stockholders are given an oversubscription privilege; that is, they obtain from the issuer an opportunity to purchase as many shares as they may want. Sometimes such issues are oversubscribed, and the company is forced to restrict the subscribers' purchases on a pro rata basis.

Bond, Stock Routes Compared

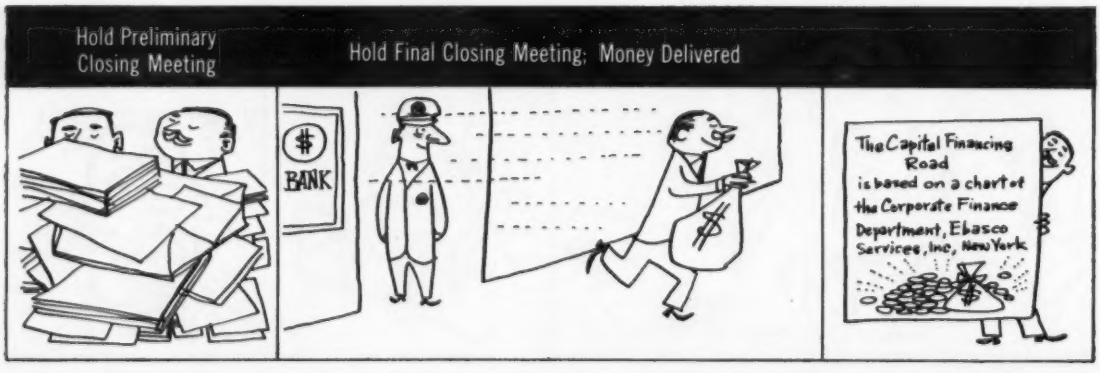
Of course utilities can also sell new preferred and common stocks on a competitive basis in the same way as first mortgage bonds were sold in the preceding article shown on pages 104 to 107.

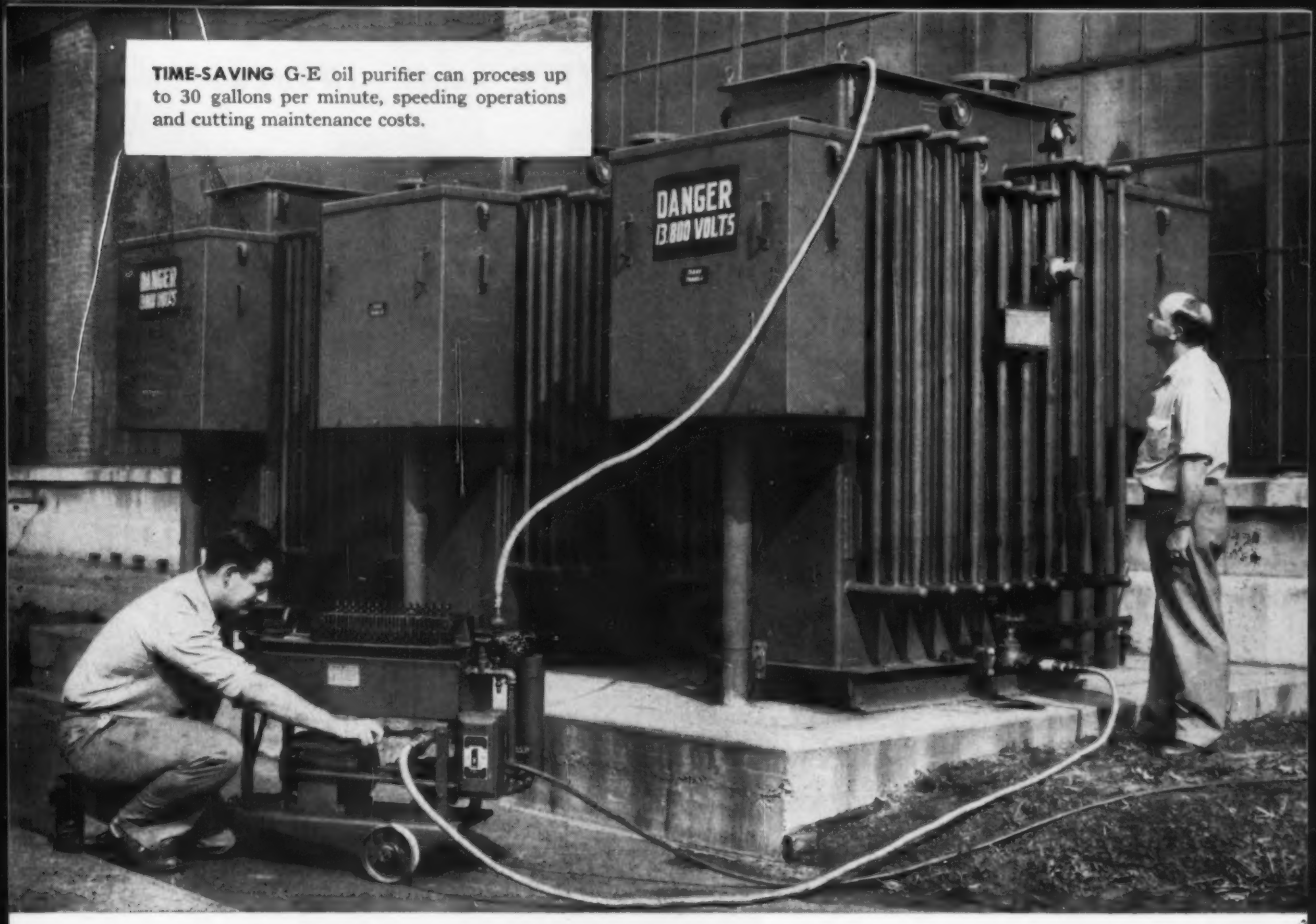
There is no difference in the marketing procedures of preferred and common shares sold to the public on a competitive bidding basis. Like bonds they are sold by underwriters.

Once a new issue of bonds, debentures, preferred stocks or common stocks has been sold, the company has little to do with future trading of these particular securities. Investors, wanting to purchase these securities after they have been issued and sold, will have to buy them from security brokers.

They can be purchased on a number of stock exchanges. The securities of many utility companies are listed on the New York Stock Exchange, the American Stock Exchange, and other exchanges in many large cities throughout the country. Some securities of utility companies are also sold on the "Over the Counter" market. In any case these sales are handled by security brokers all over the United States.

This is a general explanation of how a company sets about obtaining "new money". Much of the detail of the operation has been omitted. But the endless detail involved is a day-to-day problem of the company's financial officer.


Hold Preliminary Closing Meeting
Hold Final Closing Meeting; Money Delivered
BANK
The Capital Financing Road is based on a chart of the Corporate Finance Department, Ebasco Services, Inc, New York



TIME-SAVING G-E oil purifier can process up to 30 gallons per minute, speeding operations and cutting maintenance costs.

Cut maintenance costs with G-E Purifiers

Recondition insulating liquids quickly and easily with this low-cost device

You may be able to cut your maintenance costs in filtering insulating liquids for transformers, regulators, and other electrical equipment by using General Electric purifiers for oil and Pyranol*. The purifiers, which filter out suspended sediment and free and dissolved water, have high capacity, do high-quality work, and are easy to use.

Periodic filtering of insulating liquids to maintain dielectric strength is more important today than ever before, because many users are ordering transformers with reduced basic insulation levels. It is equally important, of course, to filter the insulating liquid when filling a tank for the first time, or when refilling an old tank. You thus safeguard equipment life and help assure continuous service to customers.

High Capacity—The new G-E oil purifier with 7-inch filter-paper plates has a capacity of 12 gallons of liquid per minute, a 20 per cent increase over other available models. This means rapid filtration, short shutdowns, and low maintenance costs. The model for purifying Pyranol has similar output. Models, using 12-inch filter-paper plates, filter 30 gallons per minute.

High-quality Work—Using adequately dried filter paper, you can normally raise the dielectric strength of oil to be reconditioned to 30 kv with just one pass through the purifier.

Easy to Use—Simplicity of operation saves time in training maintenance crews. Unskilled workmen can easily set up and operate G-E purifiers. The single-phase pump motors operate on 115/230 volts, and the filter-paper drying ovens used in conjunction with the equipment are rated for either 115/230 volts or 230/460 volts. Purifiers and ovens can be quickly connected either to single-phase lighting circuits or to one phase of a three-phase circuit.

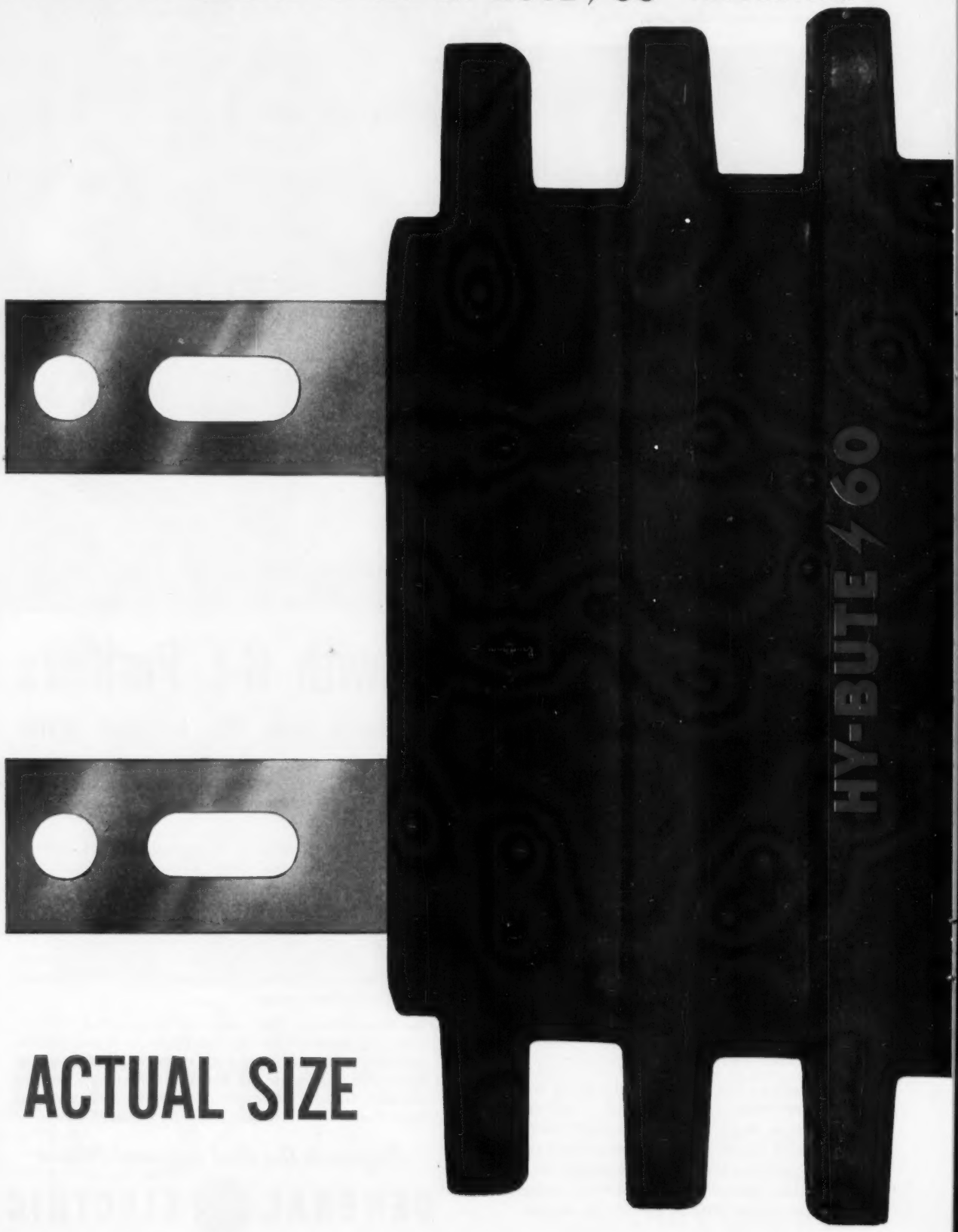
For More Details—For complete information on low-cost G-E purifiers for oil and Pyranol, drying ovens, and filter paper, contact your nearest G-E Apparatus Sales Office, or write for Bulletin GEA-1333, Section 431-45, General Electric Company, Schenectady, New York.

*Registered trade mark of General Electric Company.

Progress Is Our Most Important Product

GENERAL ELECTRIC

FIRST TO BE MOLDED IN NEW HY-BUTE ϟ 60* INSULATION



ACTUAL SIZE

G.E.'s New 15-kv Instrument Transformer Mounts Easily; Needs Less Maintenance

LIGHT AND MORE RUGGED, TYPE JKW-5 MOUNTS IN ANY POSITION

General Electric's discovery of an internal oxidation mechanism which can be added to ordinary butyl to prevent arc-tracking now makes feasible the molded construction of outdoor current transformers in the higher voltage ranges. This new compound, Hy-Bute/60 insulation, gives you seven big advantages in the new type JKW-5 15-kv instrument transformer.

NEW JKW-5 REPLACES 3 TRANSFORMERS because it can be mounted in any position. It supersedes the bottom, top and side-connected designs. This simplifies stocking and maintenance problems.

CORROSION-RESISTANT materials—new Hy-Bute/60 insulation, stainless steel and copper—virtually eliminate necessity for maintenance.

WEIGHS 20% LESS than older type, top connected transformer of the same rating.

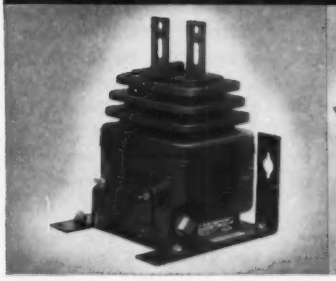
SMALLER SIZE coupled with lighter weight makes the General Electric JKW-5 easier to install. The new transformer, shown here in actual size, measures only 15¾ inches high, 10⅞ inches wide and 9½ inches long.

NO PORCELAIN BUSHINGS to crack because new Hy-Bute/60 serves as bushing, insulation and case on the new JKW-5. This feature removes possibility of failure which might occur as a result of thermal shock or external damage to porcelain bushings.

SAFER OPERATING, General Electric's Hy-Bute/60 insulated transformers cannot explode or catch on fire like older types.

LONGER LIFE is assured because Hy-Bute/60 insulation is mechanically tough, chemically inert, heat resistant, impervious to severe weather conditions and has high dielectric strength.

YOU GET SIMILAR BENEFITS IN OTHER MEMBERS OF G.E.'S BUTYL FAMILY



JKW-3 5-kv current transformer is available for outdoor applications

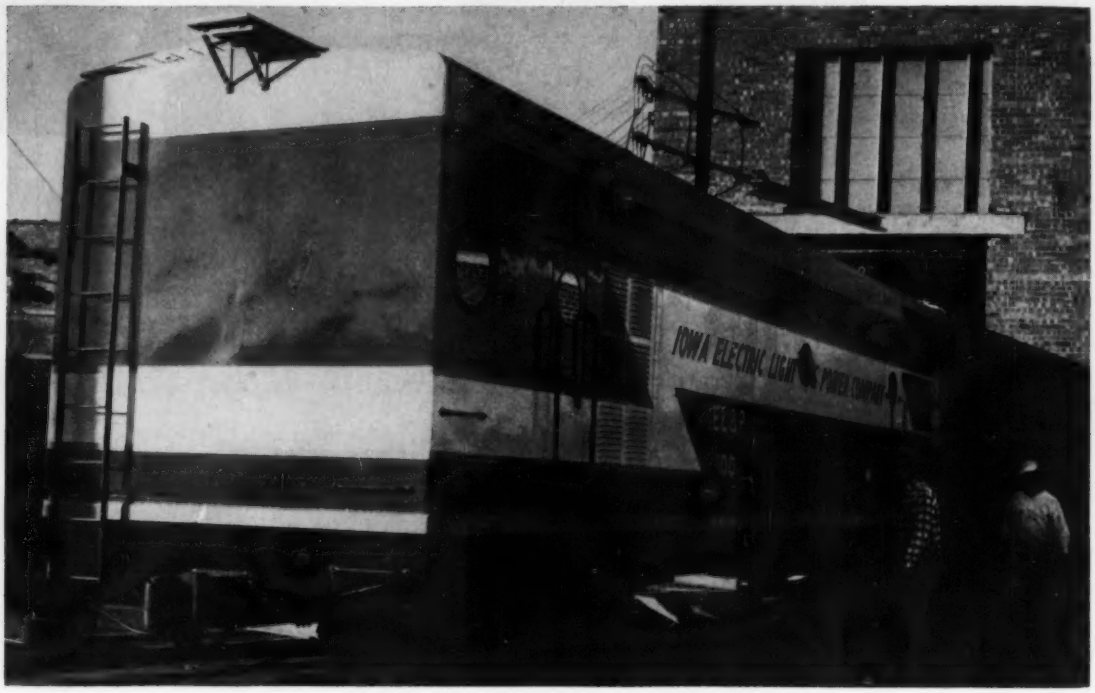
JKM-5 15-kv current transformer for indoor applications

JCP-0 600-volt current transformer for high-current indoor/outdoor applications

For more information about the new JKW-5, contact your nearest G-E Apparatus Sales Office or write for Bulletin GED-2727 to Section 581-2, General Electric Company, Schenectady 5, New York. For information about General Electric's complete line of instrument transformers, request Bulletin GEC-1028. 581-2

*Trade-mark of General Electric Co.

GENERAL ELECTRIC



GENERATION—Operation

Mobile Diesel Units Offer Reliability, Savings

J. A. WALLACE, Assistant General Production Manager, Iowa Electric Light & Power Co, Cedar Rapids, Iowa

Two 1,000-kw, dual-fuel, mobile diesel generating units are being installed by the Iowa Electric Light & Power Co at Gutherie Center, Iowa. Reasons for the installation are:

1. Maintenance of service reliability at Gutherie Center.

2. Postponement of a heavy investment for a high-voltage line until the entire load area is developed to obtain maximum use of new transmission facilities.

3. Reduction of transmission losses on the 34.5-kv system.

4. Cost of the units is low and carrying and fixed charges are less because delivery and installation require a relatively short time.

5. Automatic starting, loading, operation and shut down eliminate the operating crew.

6: During periods of gas curtailment the units are available, using oil as a fuel, to assist in "skimming" the system peaks.

These units assure uninterrupted service in the Gutherie Center area during storm conditions and when 34.5-kv transmission lines are lost or are being repaired. Their installation permits postponement of a heavy investment for a 115-kv transmission line.

One Unit in Service

One unit has been in service since last October and the second is scheduled for delivery soon. They are completely automatic, rail-type units. Upon delivery, the rail trucks were removed from the first railroad car and the unit placed on a permanent foundation.

Natural gas is available for fuel, and a small tank has been installed for oil storage. Electrically, the installation is being arranged to supply the local 2.4-kv bus and connect with the system through a 2.4/34.5-kv transformer.

Automatic control enables the plant to operate unattended with reasonable reliability. When natural gas is available, the operating impulse is a time clock so scheduled that the plant runs from 7AM to 10 PM each day. This relieves the 34.5-kv transmission line of excessive loads during the peak load period and reduces transmission losses. If, during the night, the transmission lines into Guthrie Center fail, the plant's operation is initiated by a dead line relay, and the local area load is carried until transmission lines are restored.

Local company people give the plant a brief visual inspection each day and check lubricating and fuel oil levels. The installation of the diesel units and any maintenance required is handled by personnel from the company's steam plant at Boone, Iowa, 60 miles away. Experience with the first unit to date has been favorable.

(*More How To on page* 116)

PHILADELPHIA ELECTRIC employs 5%, 13.8-kv reactor bank at Angora substation, West Philadelphia. At right, workman checks voltage on G-E 10%, 13.8-kv reactor at Spruce Street substation.

Philadelphia Electric shows how

General Electric Reactors Reduce System Investment

Philadelphia Electric Co. has adopted standardized short-circuit ratings on switchgear and other system equipment—150,000 KVA on all 2400- and 4160-volt feeders; 150,000 or 250,000 KVA on 13.8-kv lines. Reactors are used to limit feeder duties to these values. Results: cost savings through quantity equipment purchases; additional savings since reactors often permit selection of less-costly switchgear having lower short-circuit capacity.

RELIABILITY: The almost-perfect service record of G-E reactors attests to dependability of G-E cast-in-concrete design, with such features as:

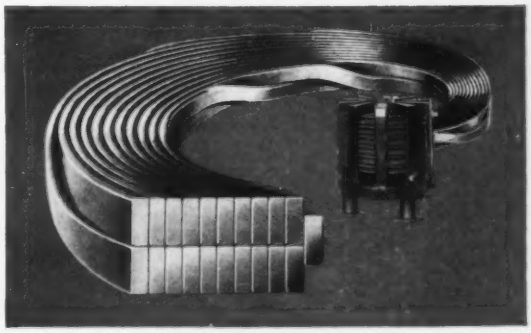
Wet-steam-cured concrete: full strength when shipped avoids potential danger of "in-service" curing.

Rectangular transposed conductors: minimum losses and increased short-circuit strength.

Non-aging glass insulation: optimum temperature and moisture resistance, high dielectric strength.

Aluminum conductors as standard construction: nearly 10% saving over designs using copper.

Repetitive-Manufacture designs with aluminum conductors: 8% added saving plus shorter shipment. For full information contact your G-E Apparatus Sales Representative, or write to Section 422-30, General Electric Company, Schenectady 5, N. Y.

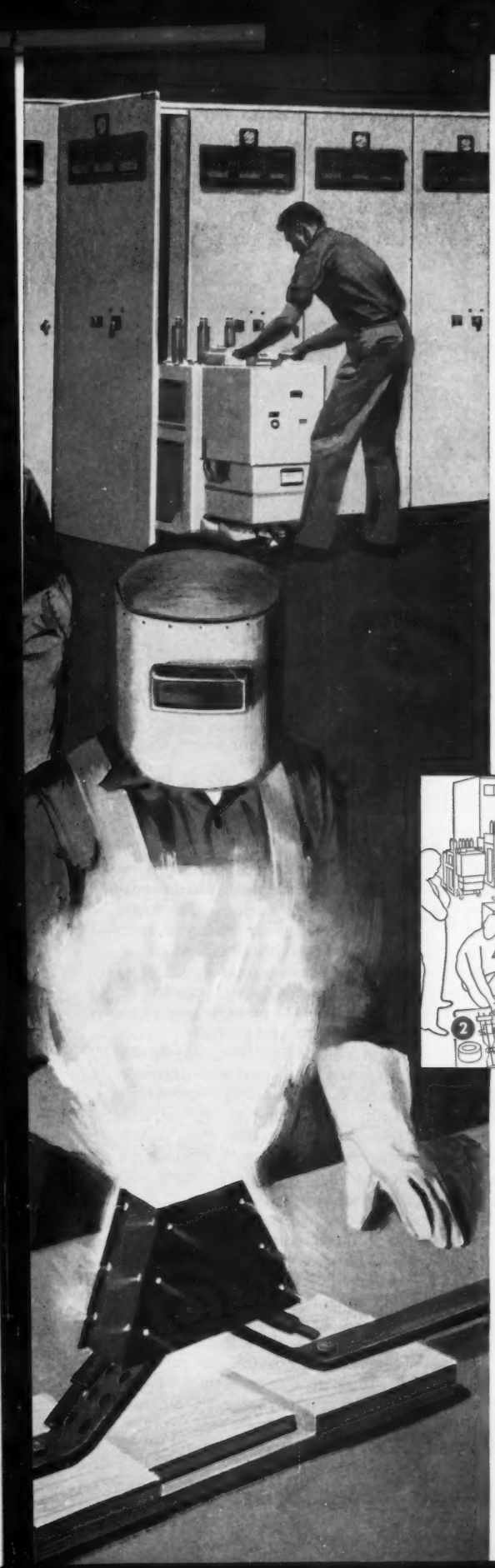


RECTANGULAR TRANSPOSED CONDUCTOR, an exclusive G-E feature, provides highly uniform current distribution with lower skin-effect losses; permits size reductions over round cable up to 20 percent without sacrificing electrical turn-to-turn insulation.

Progress Is Our Most Important Product

GENERAL ELECTRIC

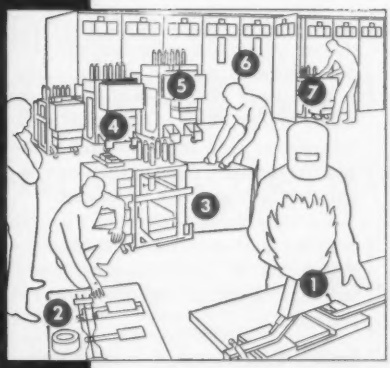
METAL-CLAD SWITCHGEAR



General Electric offers you these "plus values" in the

MOST MODERN METAL-CLAD SWITCHGEAR AVAILABLE TODAY!

Pictured here are just some of the recent design improvements in G-E metal-clad switchgear that make it the most advanced metal-clad now on the market. Check with the descriptions below—you'll agree they add up to today's outstanding switchgear value!



1. NEW SELF-X—improved flame-retardant insulation with built-in fire protection is tested by electric arc.

2. BETTER MOTOR PROTECTION new through-type current transformer speeds ground-fault detection.

3. EASIER MAINTENANCE—removal of light box barrier completely exposes main contacts for inspection *without* removal of arc chutes.

4. HIGHER RATINGS— metal-clad switchgear now available with interrupting ability up to 750 MVA.

5. 5-CYCLE CLEARING TIME—limits damage due to faults and short circuits to a minimum.

6. EXTRA STRONG ALL WELDED FRAME means switchgear enclosure will retain alignment despite jolts of cross-country shipment.

7. EASIER, SAFER HANDLING—low center of gravity due to vertical lift design virtually eliminates possibility of tip-over.

Subsequent ads in this series will deal with these features more completely. However, you can get more details immediately by contacting your G-E Apparatus Representative, or by writing for folder GER-1194, "New Design Improvements in G-E Metal-clad Switchgear" or for product descriptive bulletin GEA-5664, Section 511-15, General Electric Co., Schenectady 5, New York.

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GENERAL ELECTRIC

KEY NO. A
REF.

BUSHING RECORD

SERIAL 926640

MFG. GE CAT., DRWG. & GR., &/OR STYLE # M-1565152-G106 TYPE SI

FORM CI CLASS B37A KV 37 AMPS. 800 YR. MFG. 1931

FOUNDATION UNIT STANDARD BUSHING REPLACEMENT 3B271

OTHER INFORMATION

STATION	EQUIP. NO.	CO. NO.	POS.	DOBLE TEST	DATE	REMARKS
Harvester	M-6010861G28		1	D-4.1	9/27/49	Cork Gskts. & Sp. T. & Bott.
"	"		1	"	7/2/52	" " " " "
Trans. Shop	Spare				7/7/52	To Be Rebuilt
" "	"			G-2.0	11/24/52	Rebuilt with Black Rubber Gskts. & New Compound.
Rob. Park	M-362077209		5		5/1/53	Replaced 889013

Portion of Sample Bushing Record

The color signal code employed on these 5 x 8-in. cards follows:

Green Tab—Spare bushing suitable for service.

White Tab—Bushing in spare equipment suitable for service.

Black Tab—Spare bushing requiring rebuilding and not readily suitable at the present time for return to service.

White & Black Tab—Bushing in spare equipment that should be rebuilt or replaced.

Red Tab—Bushing in service having Doble-test rating of "D" or "R" which should be replaced.

Untabbed—Good bushing in service.

SUBSTATION—Maintenance

How Bushing Record File Can Be Simplified

MAX G. PAPAZIAN, Engineer, Substation Dept., Indiana & Michigan Electric Co, Fort Wayne, Ind.

A bushing record file's value lies in its simplicity and ease of use. Indiana & Michigan Electric Co's substation file applies to bushings rated 15 kv or higher installed in plants or stations. It does not apply to bushings for distribution transformers and regulators, the records for which would entail quite a chore and an expense hardly justified.

This system requires little work to make records for new bushings or for those for which no record cards have been made previously.

Colored Tabs Aid Reading

By the use of colored signals or tabs on the cards, substation personnel can tell at a glance how many spare bushings are suitable for service and where they are located, which spare units need repairs or rebuilding, and which bushings in service have a Doble-test rating of "D" or "R" and need replacement. No signals are attached to card records of satisfactory bushings in service.

Interchangeability of bushings is indicated by the "Key No." in the upper left-hand corner of each card. All cards bearing the same "Key No." are grouped in file according to catalog or drawing number, and the cards in each group are placed in numerical order. Hence there is no difficulty in determining how many spare bushings are on hand for any key group. Thus replacements are expedited.

No considerable attempt has yet been made to determine interchangeability of different manufacturers' bushings except as shown by field experience.

Doble Test Entered

Each card provides for entries on Doble test, maintenance work done, and a history of the specific bushing. Analysis of relative performance and scheduling of maintenance are aided by related reports. More elaborate data should be kept on 330-kv bushings than on those of lower voltage ratings, as experience with supervoltage bushings is meager.

The most important data on high-voltage bushings include power factor, date of reading, weather conditions, capacitance current, voltage between capacitance tap and ground for certain bushings, and maintenance or repair work done. But such supplementary data may be kept on supplementary records referred to in this simple record.

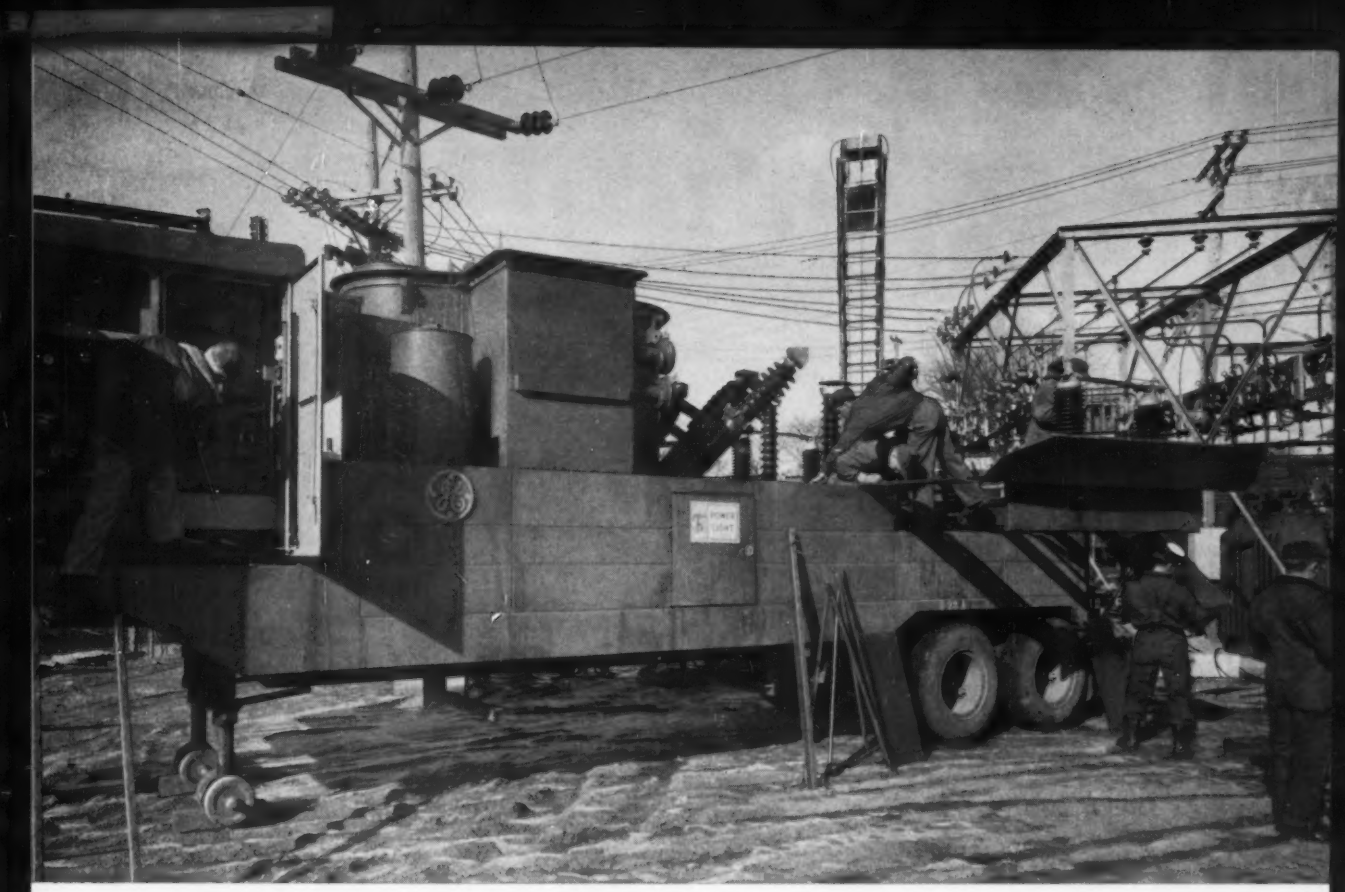
Catalog Numbers Indexed

When a replacement bushing is required, all that is needed is the catalog or drawing number. The corresponding card gives the key number of interchangeable bushings which can be selected from spares in stock or reserve equipment on authorization, or ordered from the manufacturer by referring to the key groups.

An index is kept of bushing catalog or drawing numbers, manufacturers, kv rating, and corresponding interchangeability key numbers to expedite reference to file cards when seeking replacements. Generally bushings are indexed by ground-sleeve length, voltage, and current ratings.

By keeping one set of card records in this manner, substation personnel have a fairly accurate, up-to-date record of bushings. They can ascertain promptly the number of spare units on hand, the number of bushings to be repaired or rebuilt, and the number which should be purchased for spare stock to maintain the proper number of interchangeable bushings.

(*More How To on page* 120)



GENERAL ELECTRIC Mobile Unit Substation

PAYS FOR ITSELF by reducing routine system maintenance expense

"We certainly feel that this unit is paying for itself during routine maintenance. Variations in voltage make it adaptable in many locations for a variety of jobs." This statement by Mr. Anthony Zanskas, Assistant Superintendent of Substation Construction and Maintenance, Wisconsin Power and Light, expresses the findings of many progressive utilities.

"Labor and material savings, by using the mobile unit substation for by-passing entire small substations for maintenance and transformer changes have been great, as we have been able to do this work on de-energized busses and equipment with a minimum amount of material and preparation and without any delay or outages." This additional endorsement by Mr. Carl Takle, Wisconsin P & L's Superintendent of Substation Construction and Maintenance, further demonstrates how General Electric mobile unit substations are paying off as a versatile, economical means of speeding routine system maintenance, in addition to their value as stand-by or emergency equipment.

General Electric mobile unit substations are designed for maximum versatility, with provision for various voltage combinations, if required, to meet all application needs. Each substation is a complete, fully coordinated unit, mounted on a high-speed trailer, designed for normal highway operation. For further information, contact your local G-E Apparatus Sales Office or write for bulletin GEA-4415 to General Electric Co., Schenectady 5, N. Y. 422-26

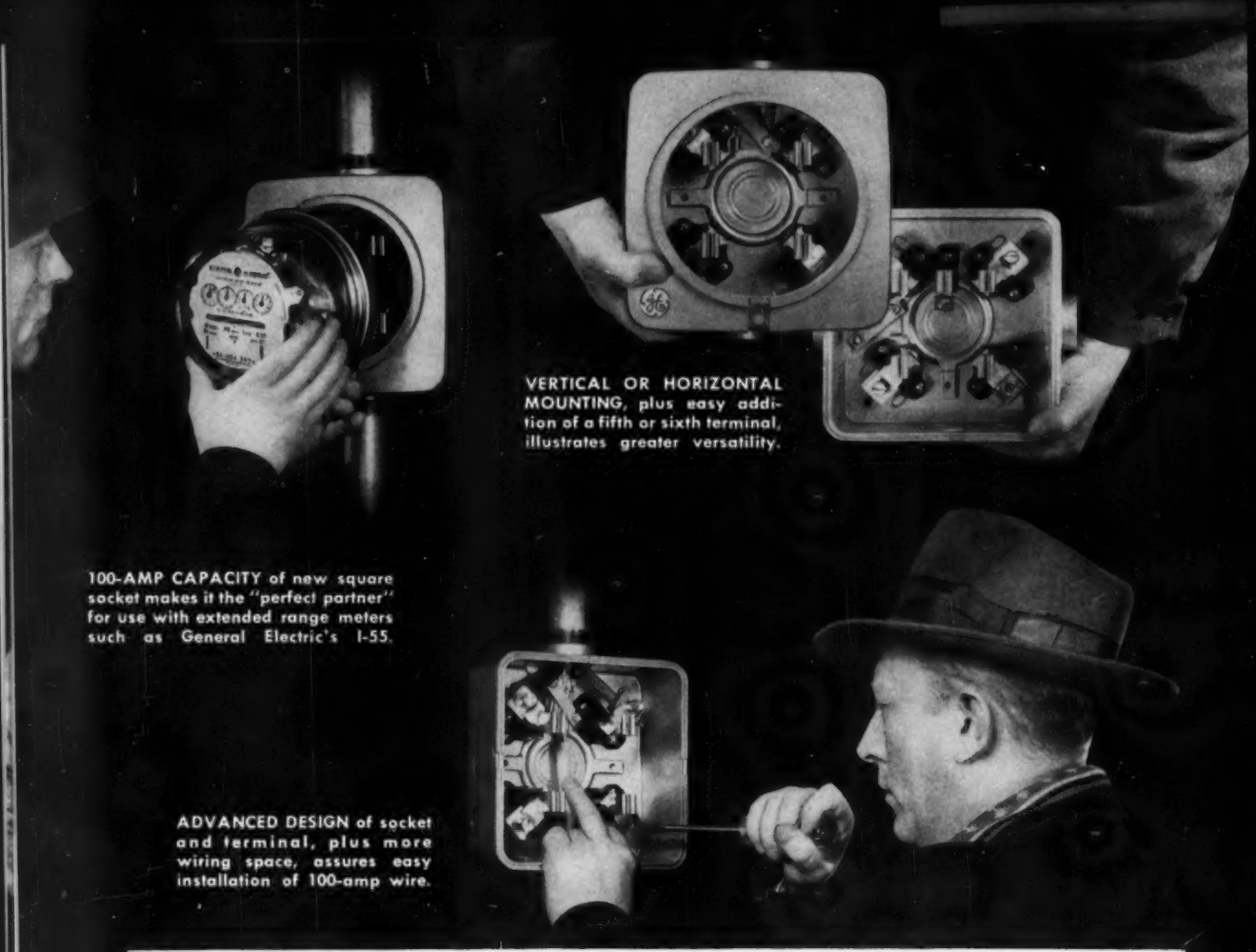
Typical six-months' operating log for Wisconsin P & L's 5000-kva G-E Mobile Unit illustrates high utilization factor. All these stops were for routine maintenance.

Location	Installed	Removed	Days	Mileage
Oregon	2–22–55	3– 6–55	13	25
Tomah	3–10–55	3–16–55	7	110
Prairie Du Chien	3–18–55	3–18–55	1	94
Baraboo	4–19–55	4–23–55	5	98
Fox Lake	5– 7–55	5–18–55	12	35
Janesville	6– 7–55	6–29–55	23	82
Mauston	7–12–55	7–19–55	8	100
Dorset	7–21–55	7–22–55	2	10
Darien	8–11–55	8–11–55	1	120
Portage	8–19–55	8–20–55	2	90
Evansville	8–23–55	8–23–55	1	45

SIX-MONTH TOTALS: 11 Locations
75 Days in Service—809 Miles Traveled

Progress Is Our Most Important Product

GENERAL ELECTRIC



VERTICAL OR HORIZONTAL MOUNTING, plus easy addition of a fifth or sixth terminal, illustrates greater versatility.

100-AMP CAPACITY of new square socket makes it the "perfect partner" for use with extended range meters such as General Electric's I-55.

ADVANCED DESIGN of socket and terminal, plus more wiring space, assures easy installation of 100-amp wire.

General Electric Announces . . .

NEW, EASY-TO-WIRE METER SOCKET FOR 100-AMP INSTALLATIONS

General Electric's new extended range square socket has been designed for meter installations requiring 100-amp capacity. The new, low-cost Type S-1 square socket combines extended range capacity with these important benefits:

EASY INSTALLATION of 100-amp capacity wire (up to # 0 gauge aluminum) is assured by greatly increased wiring space. Location of lay-in type terminals requires a wiring bend of only 45°.

EXCELLENT CORROSION RESISTANCE is provided by die-cast aluminum construction plus baked Glyptal* aluminum finish. Positive, one-way knockouts eliminate any need for prying or bending; unique pre-scoring gives you the exact knockout desired.

QUICK AND EASY ACCESS to the interior is assured by the simple snap-locking device on the socket cover . . . makes removal possible without use of screws or tools.

GREATER VERSATILITY of the new square socket permits either vertical or horizontal mounting simply by interchanging the terminals 90°. Added flexibility may be obtained by the easy addition of a fifth or sixth terminal.

FOR MORE INFORMATION contact your nearest G-E Apparatus sales representative or Authorized G-E Distributor . . . or write for bulletin GEC-1376 to General Electric Company, 625-1, Schenectady 5, New York.

*Reg. trademark of General Electric Co.

Progress Is Our Most Important Product

GENERAL ELECTRIC

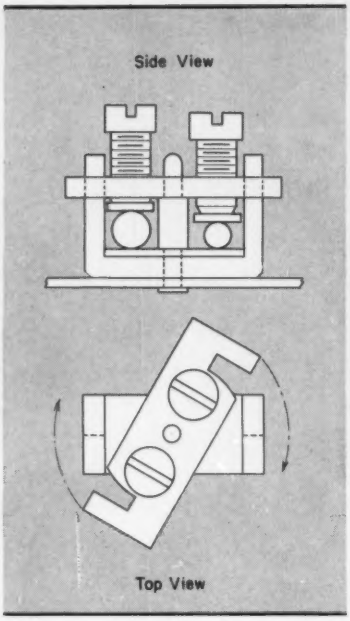
Connector Eliminates Loose Grounds

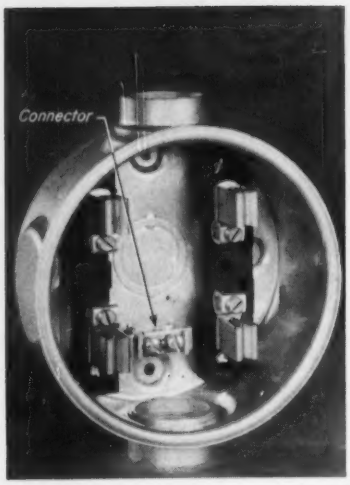
W. H. FARRINGTON, Staff Meter Engineer, Texas Electric Service Co, Ft. Worth, Texas

A meter socket ground connector has been developed by the Texas Electric Service Co, in cooperation with a manufacturer, for tightening two ground conductors of different sizes under a single washer by means of single bolts in the meter socket.

The new ground connector eliminates the loose ground connections that formerly resulted from trying to tighten two ground conductors in the standard meter socket.

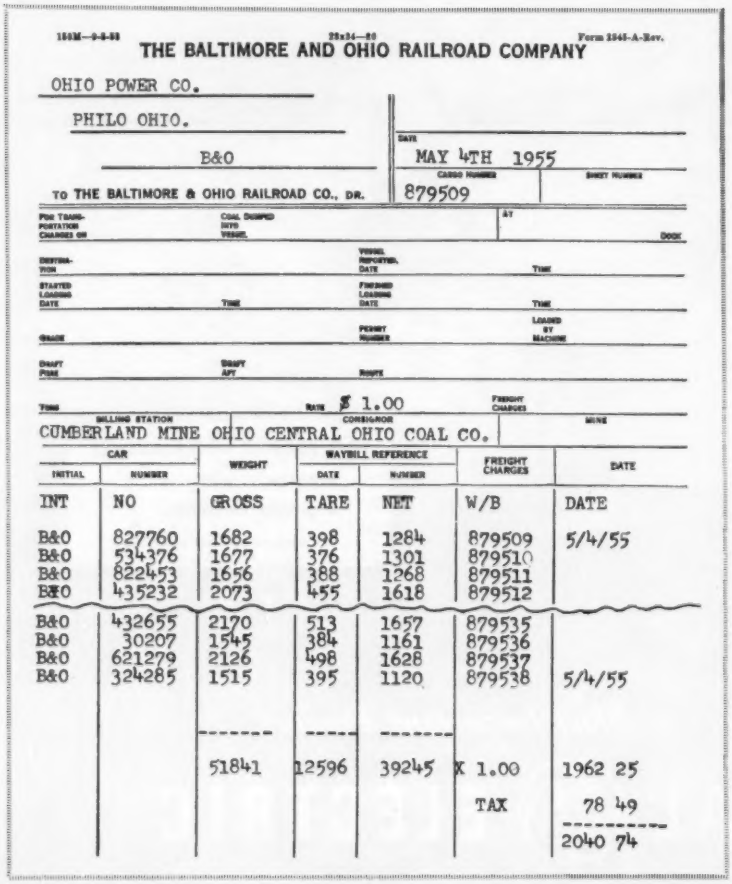
The new connector has two connector bolts and a revolving rectangular washer with a locking arrangement that keeps the entire assembly securely in place once the connections have been made.





METER SOCKET with new connector assures permanent ground connections

CONNECTOR keeps high pressure on two wires of different diameters



THE BALTIMORE AND OHIO RAILROAD COMPANY

OHIO POWER CO.

PHILO OHIO.

B&O

DATE MAY 4TH 1955

TO THE BALTIMORE & OHIO RAILROAD CO., DR. — CARGO NUMBER 879509

RATE $ 1.00

BILLING STATION CUMBERLAND MINE — CONSIGNOR OHIO CENTRAL COAL CO.

CAR INITIAL	CAR NUMBER	WEIGHT GROSS	WEIGHT TARE	WEIGHT NET	WAYBILL REFERENCE NUMBER	FREIGHT CHARGES	DATE
INT	NO	GROSS	TARE	NET	W/B		DATE
B&O	827760	1682	398	1284	879509		5/4/55
B&O	534376	1677	376	1301	879510		
B&O	822453	1656	388	1268	879511		
B&O	435232	2073	455	1618	879512		
B&O	432655	2170	513	1657	879535		
B&O	30207	1545	384	1161	879536		
B&O	621279	2126	498	1628	879537		
B&O	324285	1515	395	1120	879538		5/4/55
		51841	12596	39245	X 1.00	1962 25	
					TAX	78 49	
						2040 74	

MANAGEMENT—Accounting

Simplified Freight Billing Saves 1,000 Man-hours

E. C. SHOWERS, Philo Plant Accounting Department, Ohio Power Co, Philo, Ohio

A simplified procedure saves over 1,000 man-hours per year of clerical time in checking coal delivery billings by railroads at the Philo Plant of the Ohio Power Co. This plant receives 80 to 217 cars of coal daily over the B&O and New York Central.

The author and a B&O representative developed a consolidated bill covering all cars in any train for use in lieu of time-wasting individual freight bills, and later this simplified billing was adopted by the NYCRR.

Now only one freight bill is compiled daily for coal received from each shipper. This saves a large part of the typing and extensions. About 4 hr daily are saved in checking the freight bills, preparing them for payment, and listing them on the petty cash record. Furthermore considerable filing space is saved, as there is now only one freight bill daily for each shipper instead of one bill for each car.

(*More How To on page* 124)

One of many advantages of 90/10 Cupro-Nickel

WELDABILITY

Welding head on filter shell

One of the relatively new copper base alloys is 90/10 Cupro-Nickel, which is coming into increased use as a result of experience with it. Revere offers it in sheet and plate, pipe and tube. It is highly resistant to corrosion and erosion, particularly in salt or brackish water. In addition it can be cold or hot worked, welded, soldered and polished. Because its nickel content is less than the older 70/30 alloy, it is priced lower.

The item shown here is a 90/10 Cupro-Nickel filter for aviation gasoline, designed and fabricated by the Warner Lewis Company, Division of Fram Corporation, Tulsa, Oklahoma, for the U. S. Navy. Heads and shell are 1⅛" thick. Revere was given the opportunity to collaborate with the Warner Lewis manufacturers on welding, which was successfully accomplished by the metallic arc process, using Inco 70/30 Cupro-Nickel electrodes. The vertical weld on the shell was X-rayed 100% and found satisfactory to pass Navy inspection. Because of the thickness of the metal, it was decided to form the heads hot at around 1690° F. The forming was done by the Hackney Iron & Steel Co., Enid, Okla., which also consulted with Revere.

Warner Lewis Company of Tulsa, with representatives in 30 cities, are specializing on all types of alloy design and fabrication and inquiries of this nature are invited.

If you wish information regarding the selection, welding, or working of copper and its alloys and aluminum alloys, see the nearest Revere Sales Office.

Completed aviation gasoline filter, made of 90/10 Cupro-Nickel

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N.Y.

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere.

A Method for Selecting an

- How to determine the lighting load for emergency service
- How to find the capacity of battery equipment for that load

Selection of Battery Equipment for Emergency Service

I. Determine the requirements of the installation:

A. Load, watts, lights energized before power changeover and after power restoration (designated "normally-on").

B. Load, watts, emergency lights energized after power changeover (designated "normally-off").

C. Duration of the emergency in hours (based on local emergency code).

D. Allowable battery recharge time in hours.

II. Select the battery, based on:

A. Sum of the dc loads to be served by the battery during the emergency period (sum of the normally-on and normally-off loads in watts).

III. Select the charging unit as follows:

A. Determine the ampere-hours to be furnished by the battery. This value is the total dc load in amperes times the emeregncy period in hours.

B. Determine the high-rate ampere output of the charger. This current is the amount of the battery dis-

115-V Emergency Lighting Equipment

Battery Selection Table—60-Cell Battery Ratings

Battery Capacity in Terms of Watts on 115-V Basis (to 105 V Final, 1.75 VPC)

30 Min		1 Hr		1½ Hr		2 Hr		Trickle	8-Hr Dis.
Amp	Watts	Amp	Watts	Amp	Watts	Amp	Watts	Rate, amp	Rate, amp
10.2	1,173	7.4	851	6.1	702	5.2	598	0.015	2
15.3	1,760	11.1	1.277	9.13	1,050	7.85	903	0.023	3
20.6	2,369	14.3	1,645	11.1	1,277	9.35	1,075	0.028	3.75
30.4	3,496	21.2	2,438	16.4	1,886	13.6	1,564	0.036	5
35.4	4,071	25.2	2,898	19.8	2,280	16.4	1,886	0.047	6.25
45.6	5,244	31.8	3,657	24.7	2,841	20.4	2,346	0.056	7.5
53.1	6,107	37.8	4,347	29.7	3,415	24.6	2,829	0.071	9.4
58	6,670	37.6	4,320	29.3	3,370	24.2	2,783	0.068	9
60.8	6,992	42.4	4,876	32.9	3,784	27.2	3,128	0.075	10
70.8	8,142	50.4	5,796	39.6	4,550	32.8	3,772	0.094	12.5
76	8,740	53.8	6,187	41.1	4,727	34	3,910	0.094	12.5
80	9,200	54	6,210	41.3	4,750	34	3,910	0.094	12.5
86	9,890	56.4	6,486	44	5,060	36.4	4,190	0.101	13.5
88.5	10,178	63	7,245	49.5	5,690	41	4,715	0.117	15.6
98	11,270	65.8	7,567	51.3	5,900	42.5	4,890	0.118	15.8
106	12,190	74.2	8,533	57.4	6,601	47.6	5,474	0.131	17.5
110	12,650	75.2	8,648	58.6	6,740	48.5	5,578	0.135	18
122	14,030	84.8	9,752	65.8	7,567	54.4	6,256	0.150	20
138	15,870	100	11,500	80	9,200	67	7,705	0.188	25
141.6	16,284	101	11,615	79.2	9,110	65.6	7,544	0.188	25
162	18,630	120	13,800	94.5	10,868	78.6	9,039	0.225	30
165	18,975	120	13,800	96	11,040	80.4	9,246	0.225	30
189	21,735	140	16,100	110	12,650	91.7	10,546	0.263	35
193	22,195	140	16,100	112	12,880	93.8	10,787	0.263	35
216	24,840	160	18,400	126	14,490	105	12,075	0.300	40
220	25,300	160	18,400	128	14,720	107	12,305	0.300	40
243	27,945	180	20,700	142	16,330	118	13,570	0.338	45
275	31,625	200	23,000	160	18,400	134	15,410	0.375	50
297	34,155	220	25,300	173	19,895	144	16,560	0.413	55
330	37,950	240	27,600	192	22,080	161	18,515	0.450	60
375	43,125	277	31,740	223	25,645	186	21,390	0.525	70
422	48,530	312	35,880	245	28,175	203	23,345	0.570	76
428	49,220	316	36,340	254	29,210	212	24,380	0.600	80
475	54,625	351	40,365	275	31,625	229	26,335	0.641	85.5
535	61,525	395	45,425	317	36,455	265	30,475	0.750	100
581	66,815	429	49,335	337	38,755	279	32,085	0.784	104.5
642	73,830	474	54,510	382	43,930	318	36,570	0.900	120

Emergency Lighting System

L. E. WELLS, Director of Engineering, Exide Industrial Division,
Electric Storage Battery Co, Philadelphia, Pa.

charge in ampere-hours divided by the allowable recharge time in hours.

C. Select the charger from a charger rating list.

D. Check the allowable maximum and minimum high-rate charge current to the battery.

1. Recharge rate in amperes obtained in Par. B should be between 20% and 50% of the eight-hour discharge rate of the battery.
2. High-rate current of the charger is adjustable between the limits in the charger data table, and this current required by the battery must fall within these limits.
3. If the maximum allowable recharge rate of the battery is lower than the minimum output of the charger, select the next smaller size charger.
4. If the minimum allowable recharge rate of the battery is higher than the maximum output of the charger, select the next larger size charger.

IV. Select an automatic transfer switch based on:

A. The ac service for which the dc emergency service is substituted. Standard switches are designed to operate at specific voltages, and to open and close single-phase, 2 or 3-wire circuits or 3-phase, 4-wire circuits.

B. Current of the normally-on and normally-off loads to be carried by the switch, and the current-carrying capacity of each pole on the switch.

Note: All apparatus on the emergency circuits must be suitable for operation on dc power.

Automatic Charge Units

115-V, 60-Cps, Single-Phase, 2 Wire Supply

Charger Output Range		Max. Amp-Hr
High Rate, amp	Trickle Rate, amp	Available in 12 Hr
1–2	0.01–0.26	24
2–4	0.02–0.52	48
4–6	0.04–0.80	72
8–12	0.08–1.6	144

Automatic Transfer Switches—Solid Neutral Type

AC Service			Total Load "Normally On"			Total Load "Normally Off"		
Phase	Wire	Volts	Poles	Amp	Watts	Poles	Amp	Watts
1	2	115	1	30	3,450	1	30	3,450
1	3	115/230	2	60	6,900	1	30	3,450
3	4	115/199	3	90	10,350	(no circuits		
1	3	115/230	2	120	13,800	provided; see		
3	4	115/199	3	180	20,700	contactors below)		

Notes:
(a) The watt load must be so divided that ampere rating of each pole is not exceeded.
(b) All apparatus on emergency circuits must also be suitable for operation from a dc source.

Contactors For Use with Transfer Switches

(When Switches Do Not Have "Normally Off" Circuits)

Poles	"Normally Off" Amp	Watts
1	30	3,450
1	60	6,900
1	100	11,500

Transfer Switches and Chargers

Storage battery companies will furnish outlines, mounting dimensions, and weights of various models of transfer switches and chargers.

An Example for Selection of Battery Equipment

I. Given the requirements:

A. Emergency lighting service is desired on a single-phase, 3-wire, 115-v circuit.

B. Normally-on load (supplied from either the normal ac source or the battery) is 4,500 w.

C. Normally-off load (supplied by the battery only during emergency) is 3,000 w.

D. Emergency service is desired for 1.5 hr. Minimum voltage is 105 v. Allowable battery recharge time is 12 hr.

II. Select the battery according to load:

A. Total connected load = 4,500 w + 3,000 w = 7,500 w.

B. Refer to a list of batteries for 115-v lighting systems and select the type of a 60-cell battery (1.75 v per cell) to carry the 7,500 w for 1.5 hr (in accompanying table, nearest rating is 7,567 w).

III. Select the charging unit according to ampere-hours:

A. Total load = (7,500 w ÷ 115 v) x 1.5 hr = 98 amp-hr.

B. High-rate output = 98 amp-hr ÷ 12 hr = 8.17 amp

C. Refer to an automatic charging unit table and select the type of charger for the above output (in accompanying table, select an output range of 8-12 amp).

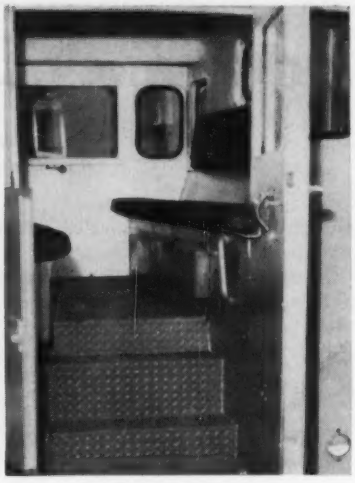
D. Determine the 8-hr discharge rate of the selected battery (for 7567 w, rate is 20 amp). If 50% of the battery discharge rate is less than the charger rate then the charger is suitable for the battery (50% x 20 = 10 amp which is within the range of the 12-amp charger).

IV. Select the automatic transfer switch for load:

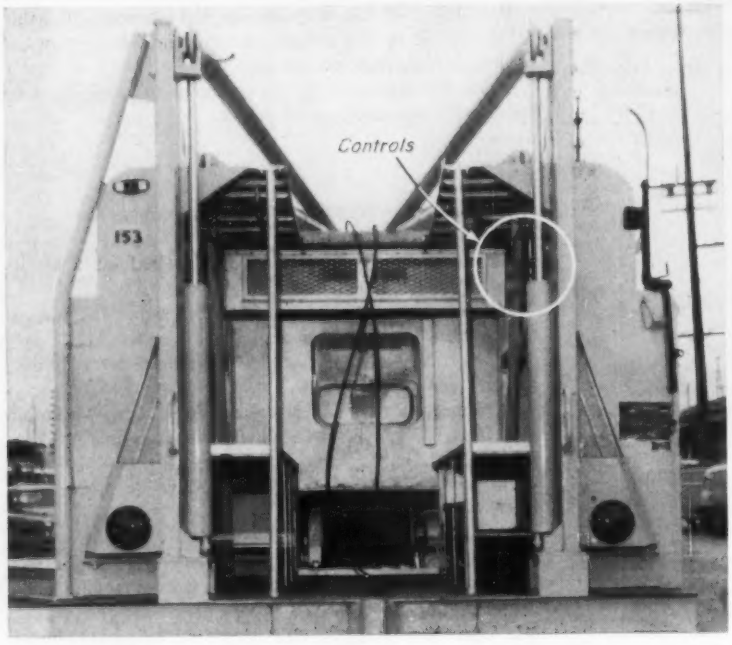
A. The ac service is single-phase, 3-wire.

B. Refer to a table of switches to carry the normally-on and normally-off loads (in accompanying table, select switch which will carry 6,900 w and 3,450 w loads).

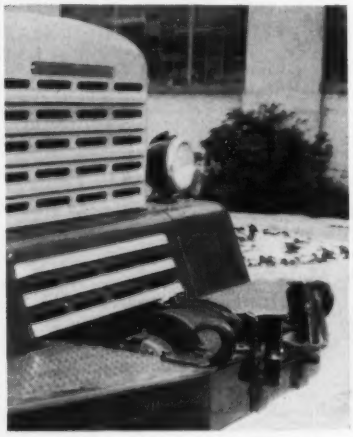
Fleet Addition has 9,000-lb derrick . . .



. . . heated compartment . . .



. . . inside derrick controls



15,000-lb front-end winch . . .

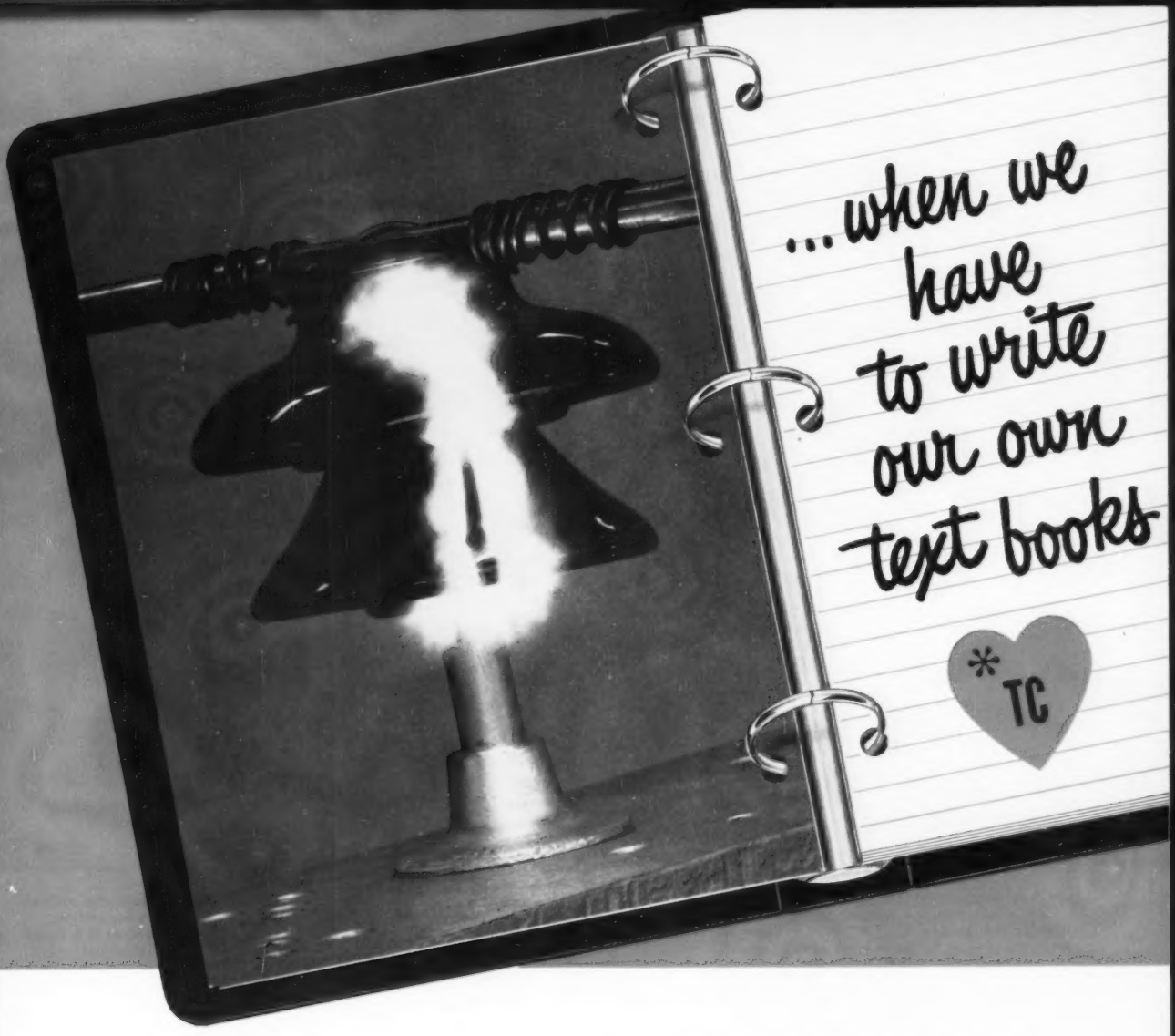
Line Truck Has Built-in Efficiency and Safety

Controls for the hydraulic derrick are inside the body of the newest line truck added to the Seattle City Light fleet. In this location, the controls require the operator to be on the truck when operating them. This arrangement gives the operator greater visibility and safeguards him against electric shock should an energized line contact any part of the truck.

The newest truck is a 30,000-lb gross weight all-wheel drive vehicle. It has a pole-setting body with a 9,000-lb capacity hydraulic derrick and a ten-man crew compartment. The truck is equipped with a 15,000-lb, front-end winch, a 20,000-lb, rear-end winch, and stabilizers.

Additional equipment and changes added by City Light include streamlining the front bumper by bending the ends back about 10 in.; directional signals; moving the exhaust pipe from a horizontal to vertical position; and a folding rear step. For greater comfort, a heater is located in the crew compartment. The truck has two-way radio, ladder racks and a permanent fair-lead for the front winch. In addition to conventional trays, racks, and bins, the truck has a compartment for a track jack.

(*More How To on page* 129)



● "Box-car figures" don't mean much in describing this impulse flashover. Try to visualize such factors as: Rate of voltage rise, 8,000 kv per microsecond, (eight trillion volts per second!). Flashover occurring in .06 microsecond (six one-hundred-millionths of a second!)

It is estimated that this is roughly twice the expected rate of rise of natural lightning. Destructiveness of the wave is far greater than this simple relation.

Production of such test waves, their control, and their oscillographic measurement, involve advanced laboratory technique. Obviously they are a boon to the designer of insulators and, in turn, to the user.

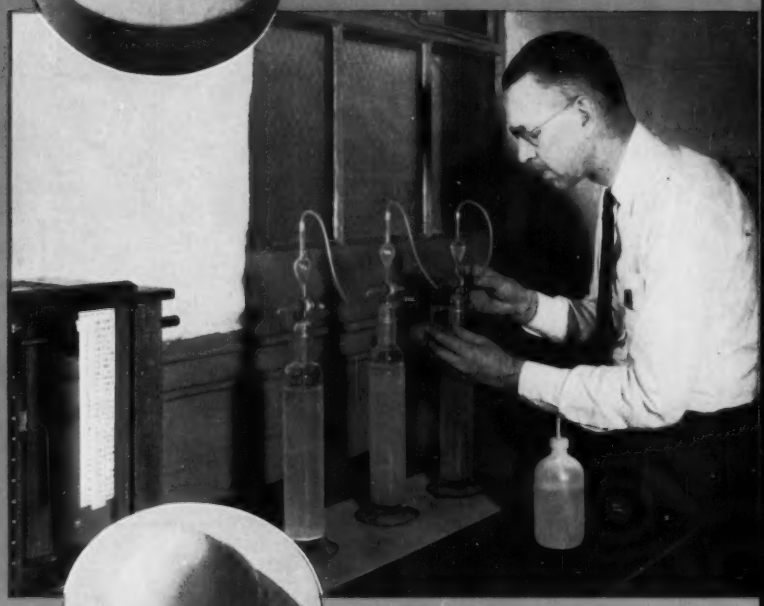
Now, the O-B High Voltage Laboratory has made another important stride. Studies are in progress relative to the corona field surrounding an insulator in the range of one-hundred-millionth of a second immediately preceding flashover -- that moment of extreme trial imposed on an insulator. (See Paper No. 56-201 presented before AIEE Winter Meeting, Jan. 30 - Feb. 3, 1956). Pictures and descriptions of such tests will soon be published.

Only through large business volume and, consequently, broad distribution of costs can an organization such as ours afford to explore new scientific frontiers. It is in such fashion that the electrical industry receives a priceless dividend from the use of O-B products.

OHIO BRASS COMPANY, MANSFIELD, OHIO
In Canada—Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

*TECHNICAL COMPETENCE the heart of every Ohio Brass insulator

First "coarse" particle size determination is done by sifting a known quantity and then weighing the residue. From 90 to 93 per cent of properly ground Feldspar must pass through screens having 100,000 openings per square inch.

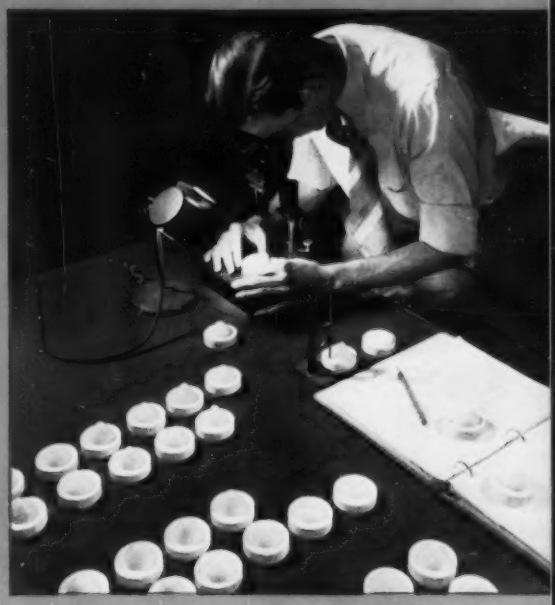


Precision test for particle size utilizes Stoke's Law relating to the settling rate of various sizes in a liquid suspension over a given period.

A very consistent raw material - *usually* !

*TC

At specified times for about two days, an exact volume of water containing suspended particles is withdrawn from the same height in these settling cylinders. This is then evaporated, and the residue carefully weighed. The result is an extremely accurate measurement of both particle size and percentage of sizes in the test specimen.



Like pats of butter, conical molded shapes of Feldspar are placed on refractory supports and fired through experimental kilns which have an extremely accurate program control. Loss of original shape, and certain surface effects, indicate the flow characteristics of the material. From this we can evaluate its suitability as a binder and either accept or reject the shipment under test.

When Grandmother's cake fell, it was a sign something had gone wrong. Technicians in the O-B laboratory look for trouble the same way, except they work with little "cup-cakes" of Feldspar.

One of many constituents of porcelain, Feldspar performs the vital function of a binder. It must become "wet" in the heat of the kiln in order to do its work, but if it becomes too fluid, not only shape of the insulator but electrical and mechanical properties may be changed. Therefore, our little test cakes must show clear evidence of reaction to heat but they must not fall.

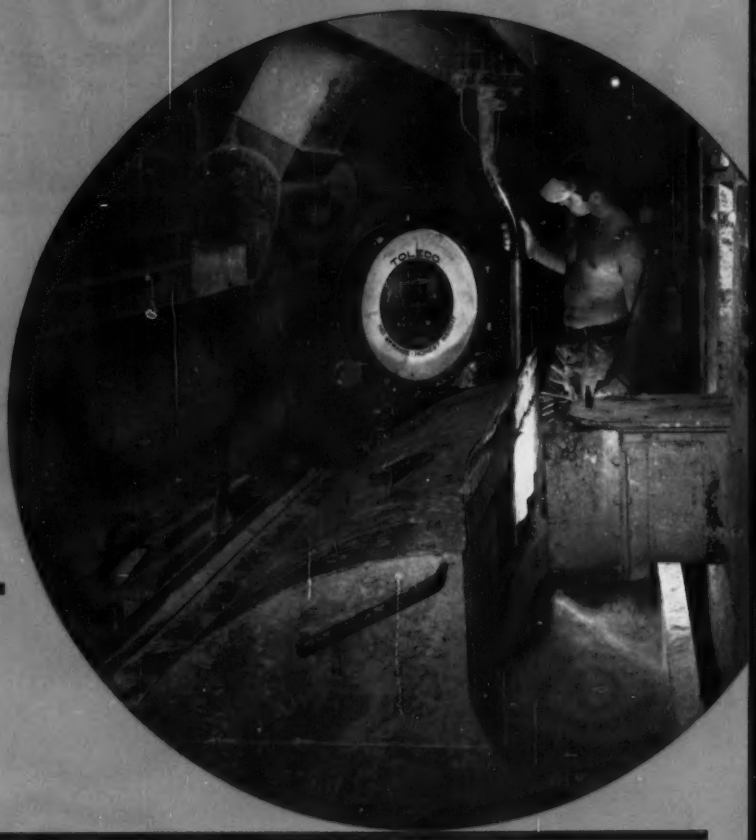
Another thing, Feldspar must be perfectly distributed throughout the porcelain mix so it can weld all particles into a dense mass. These particles are microscopic or sub-microscopic in size, hence Feldspar must be proportionally fine. Therefore, a check on grinding is needed.

Commercial shipments of Feldspar, coming from the same locality and passing through the same processing, might be assumed to be alike. This assumption is usually right. But "usually right" isn't quite good enough for a product such as insulators, where every piece has only the choice of being either "perfect" or "scrap."

Admitting the *un*-usual, testing every incoming shipment, investing time, trouble, and expensive facilities just to find an occasional mistake is classed as a "frill" by some people. But it is such frills that go to make the sound core of Technical Competence, the heart of every O-B insulator.

*TECHNICAL COMPETENCE the heart of every Ohio Brass insulator

benefit the MAN and you benefit the PRODUCT



*TC

Back in the days of shovels and tote boxes, batching of porcelain clays was a dusty, dirty, unhealthful job. Nowadays it is almost a "white collar" occupation. Good working conditions attract good men who start good products on their way. Rigid manufacturing control begins here.

Clays are stored in huge vertical bins, like large silos. Rail cars run along the block-long batching gallery at the base of these bins, extracting the many ingredients called for in a porcelain compound. Every material is noted, and weight is automatically recorded, on a printed tape that is turned over to the foreman for check before the carload is discharged into our clay mixing machinery.

Complex exhaust systems withdraw dust right at the point of discharge. The batching gallery -- once a nightmare -- is now a clean, orderly, healthful place to work.

Granted, the welfare of workmen was our chief incentive, but the biggest material dividend has been the near-disappearance of carelessness and errors in this vital step of manufacture.

This story of clay-batching presents an opportunity to make another point. Just like the car going from bin to bin, picking-up a little of this and a little of that, we go from operation to operation in our plant, picking up one improvement after another. When all mixed together they become one of the basic elements of Technical Competence, the heart of every O-B insulator.

OHIO BRASS COMPANY, MANSFIELD, OHIO
In Canada—Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

4654-H

*TECHNICAL COMPETENCE the heart of every *Ohio Brass* insulator

Auxiliary Entrance Cuts Utility Costs

DOUGLAS JOHNSON, Sacramento Municipal District Sacramento, Calif.

An auxiliary service panel used in houses under construction in the Sacramento, Calif., area is saving time and money for both the electric utility and building contractor. The meter-box and convenience-outlet combination eliminates the need for a temporary service and reduces the calls utility crews make to houses under construction.

Developed and submitted for patent by Hill Electric Co, North Sacramento, the auxiliary panel consists of a meter socket, a two-prong meter base, circuit breaker, and outlets for 120 and 240-v service. Equipment is housed in a steel panel box which can be plugged into the meter socket on the building. The device leaves the building's service box "cold". Power can be taken by extension cord from the convenience outlets for such operations as finishing construction, floor sanding, and drying-out during inclement weather.

Through use of this unit, the utility makes only the permanent service drop to the building. A temporary drop and service pole are eliminated. Other utility calls are necessary only for meter setting—once for a meter in the auxiliary unit, and again for moving the meter to the socket.

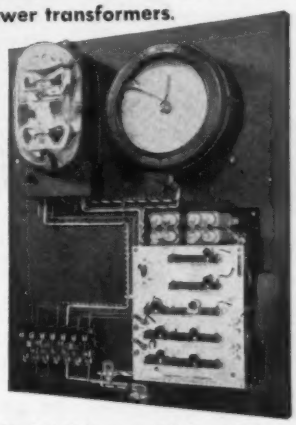
The electrical contractor saves time and money by not having to build or install a temporary service pole. From the utility's standpoint, less energy is "lost" through tapping-in practices. All energy used during construction is metered through the auxiliary entrance and can be billed to the builder. In Sacramento, the builder saves "up and down" charges of $15 for service to a temporary pole.

The device was developed by Virgil Hill at the request of a local builder who is using the panels on homes under construction. The unit costs $45 and can be used on single-phase, two or three-wire.

(*More How To on page* 130)

Transformer Loss Compensator *Saves you Money!*

BECAUSE it provides an accurate means of measuring the energy and demands of high-voltage services at the low-voltage side of the power transformers.



This installation at 2.3 kv saved about $2600 compared with 34.5 kv metering; it saves about $5500 over metering at 69 kv.

THE TESCO compensator adds to the registration of the watthour meter an amount equal to the sum of the iron and copper losses of the transformer bank. It may be used with practically any type of watthour meter and . . . importantly . . . no changes are made in the meter itself, either structurally or in adjustments . . . It is produced in two and three element types for use with two-element or three-element meters on any type circuit.

Some of the Users . . .

Phila. Electric Co. Penna. Power & Light Co. Texas Power & Light Co. U. S. Bureau of Recl. Public Service Co. of New Hampshire. Utah Power & Light Co. Northern States Power Co.

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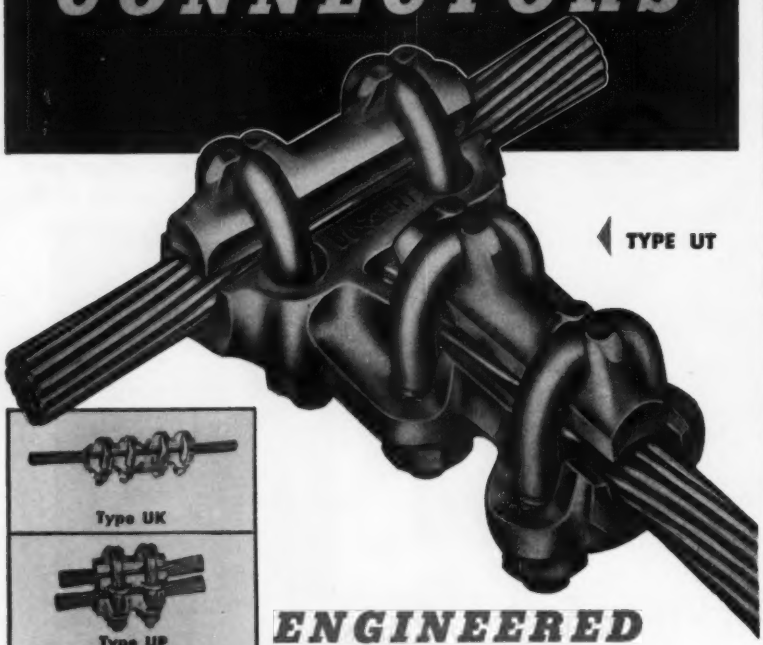

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Type UP

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Type UPT

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VARIABILITY

Fits many cable sizes, reduces number of connectors needed for given number of combinations of conductors.

HIGH CLAMPING ACTION

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Turbine Insulating Blankets Save Time and Money

A. L. SMITH, Sporn Plant Project Engineer, Central Operating Co, New Haven, W. Va.

Spun-mineral wool mats or blankets are being tried as turbine insulation at the Central Operating Co's Sporn Plant, where they were first used for the top-half shell of one intermediate-pressure turbine.

After the new blanket insulation had been in service about a year, it was found on removal to be in a suitable condition for replacement. Apparently this type blanket can be used indefinitely when handled carefully during removal and replacement. Besides saving insulating material, the blankets reduce the man-hours for application and cleaning up more than 93%. Only 5 man-hours are required to replace them instead of the 35 man-hours for application of the old type insulation and 40 man-hours for cleaning up the floor afterward.

Initially Sporn Plant turbines were insulated with magnesia block and insulating cement as is customary at most American Gas and Electric plants. The cement was mixed on the job with water and dry fibers for trowel application. This insulation could not be used easily again.

The new mats were designed for the specific job. There is no additional heat loss from the turbine shell as the insulation efficiency remains unchanged.

Two types of spun-mineral wool blanket are used. One is applied next to the turbine; over it goes the second type placed to cover the joints in the first layer. Both types measure 24x96 in. but have different thicknesses and binders.

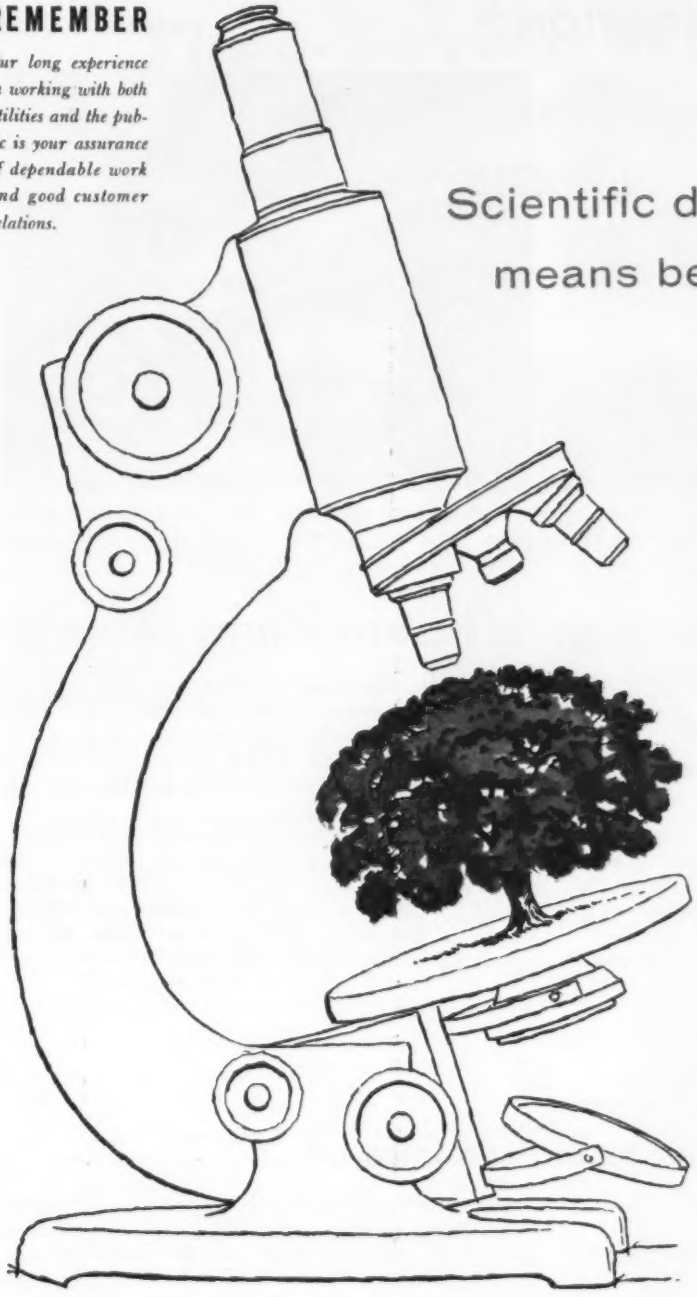
The inner layer is 2½-in. thick and has expanded monel lath on the turbine side and monel mesh on the other. It costs $1 per sq ft. Tie wires hold the sections together and to the outer layer.

The 2-in. thick outer layer has monel mesh on both sides, and costs 80¢ per sq ft.

These blankets are made to the plant's specifications and are not stock items. A set of them has been used to insulate Unit 3 IP turbine shell.

REMEMBER

Our long experience in working with both utilities and the public is your assurance of dependable work and good customer relations.



Scientific diagnosis means better tree care . . .

The basis of any curative treatment for either plants or animals is accurate diagnosis, plus the skill and experience to bring it to a successful conclusion. This means research, not guesswork as well as the best of equipment and ability.

You won't see many tree laboratories comparable to our 200-acre experimental ground and research unit at Stamford, Connecticut, where the day-to-day problems encountered by our field men are diagnosed and ideas for the protection of shade trees are tested and developed under actual growing conditions. These laboratories call for a big investment in both time and money. But to us who want to be sure of results, this painstaking research for the best possible treatment is worth it.

Couple this with an efficient highly skilled field force, thoroughly familiar with local conditions, and you have the well balanced Bartlett organization capable not only of rendering scientific diagnosis but of executing the prescribed treatment in efficient, economical fashion. It is the reason why more and more people are turning to the Bartlett Way—the Scientific Way. It costs no more and it is safer and more economical in the long run.

Consult your local Bartlett representative today for a study of your tree situation. You will benefit by his recommendations.

The Bartlett Way

BARTLETT TREE EXPERTS

Home Office, Research Laboratories and Experimental Grounds, Bartlett School of Tree Surgery, Stamford, Conn.
Local Offices from Maine to the Carolinas, and West to Indiana.
See your Local Telephone Directory for Local Address.

MORE THAN 70 FT-C is maintained at desk level. Two-lamp 40-w fixtures spaced 8 ft apart also shed light on ceiling

ATMOSPHERE OF GENIALITY is enhanced by 40-w deluxe warm lamps and 100-w units recessed into lower ceiling

New Lighting Improves Efficiency and Morale

A 277/480-v lighting system was chosen to cut wiring costs 30% in plant, offices, cafeteria

DON KEARTON, Industrial Sales, Portland General Electric Co, Portland, Ore.

Good lighting has improved employee efficiency and morale at the Oregon Chain Saw Co, Milwaukee, Oregon. Wiring costs for the installation were cut about 30% through use of a 277/480-v system. New lights were put in the assembly area, offices, and employee cafeteria.

The best working conditions possible was the goal in equipping the new plant with a lighting system. In the assembly area, continuous rows of fluorescent fixtures, each mounting two 90-w T 17 lamps, are placed on 9 to 9½-ft centers at a height of 12 ft. With 10% of the light directed to the ceiling, the installation provides over 100 ft-c on the working surfaces.

In the company cafeteria, continuous rows of two-lamp, 40-w, deluxe warm fluorescent fixtures provide 30 ft-c. The area under a dropped portion of the cafeteria ceiling is lighted by 100-w recessed units behind glass diffuser plates. In the offices, two-lamp 40-w fixtures on 8-ft centers mounted at 8½ ft provide over 70 ft-c.

A Leaf from a Power Salesman's Notebook . . .

New Food Product Owes Its Birth to Infrared

WILLIAM J. MARTINOV, Commonwealth Edison Co, Chicago, Ill.

Initial contact with Maize Industries was made on a cold canvas basis. This customer was producing potato chips. His total electrical load was less than 10 kw. Object of the call was to develop customer relations.

Further periodic visits to the plant finally established our friendship on a first-name basis. It was only then that the customer divulged the fact that he was experimenting with a new food product—and was having difficulty. He was trying to produce from corn meal a snack that would remain edible over a period of time.

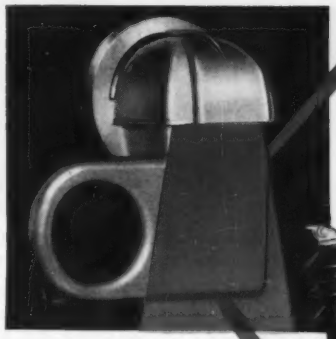
This had never been done, and many manufacturers were racing to market such a product first. But once he disclosed his problem, the way was clear for us to find some way of removing moisture in the raw product so that processing could be completed.

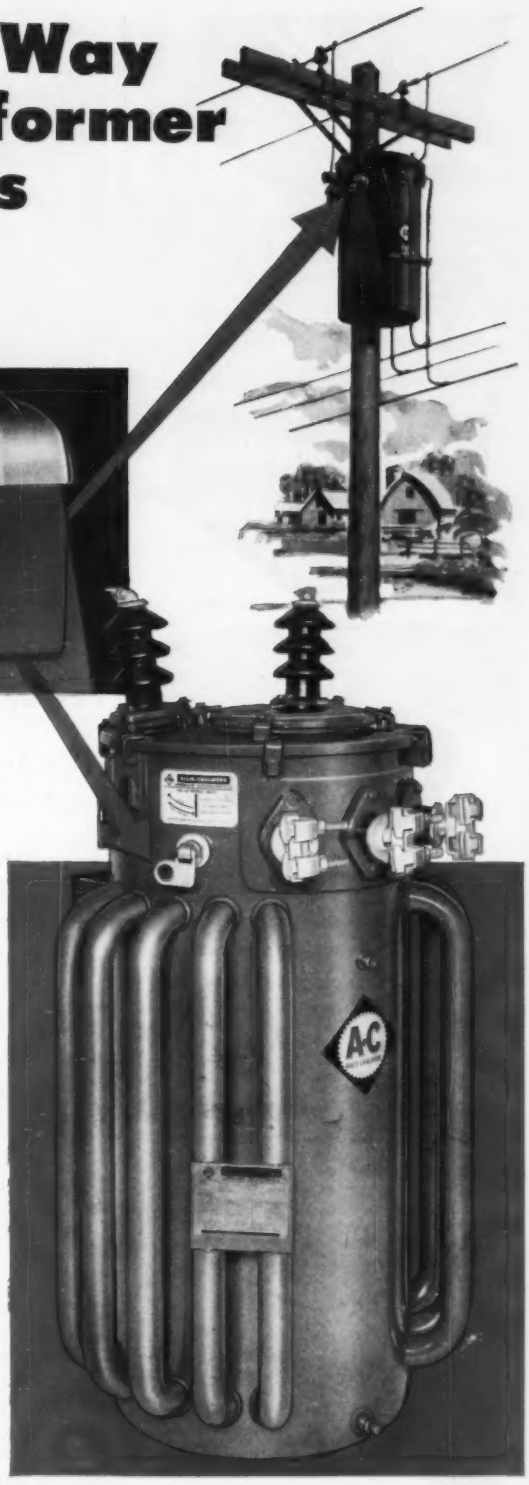
Together with Commonwealth Edison's heat expert, Mr. Harold Bunte, we experimented with various types of heat, amounts of heat, time cycles, etc. We finally achieved satisfactory results with a 24-kw infrared drying oven on the customer's conveyor line.

The customer later moved to Earlville, Ill., to expand production. His product now is marketed under franchise to protect its quality features. Popularity of the product should grow, and it follows that wherever production of this product is set up, there will be an infrared oven on the job.

And it follows that behind many a new product, or process, is the work of a good power salesman. When a power salesman calls, invite him into your office and get to know him. Some day he may be able to help you too.—The Editor

Time-Saving Way to Check Transformer Overloads





Signal light of *Thermalite* indicator singles out overloaded transformers — eliminates wasted time checking every unit

Thermalite indicator gives advance warning of overloads — in time to make changes without interrupting service. Thermal element is located in the top oil, safely away from all live parts.

Thermalite indicators are designed to take the following load factors into account, automatically:

1. High ambient.
2. Amount of overload.
3. Duration of overload.

Indicator actuates a signal lamp that remains lit till reset by means of a conventional external handle.

No false alarms! *Thermalite* indicators do not operate on momentary overloads.

And you stretch transformer dollars. Low-cost *Thermalite* indicators on your transformers let you utilize the inherent overload capabilities of your equipment. Get them on Allis-Chalmers transformers 167 kva and smaller, 15 kv and below.

For more information write or call your nearby A-C office, or Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Thermalite is an Allis-Chalmers trademark.

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EVERSTICK ANCHORS...

EXTRA Holding Power
QUICKLY Installed
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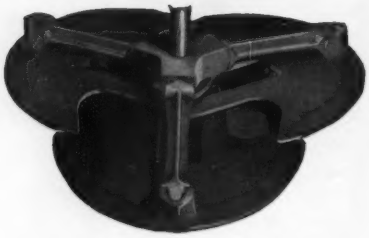
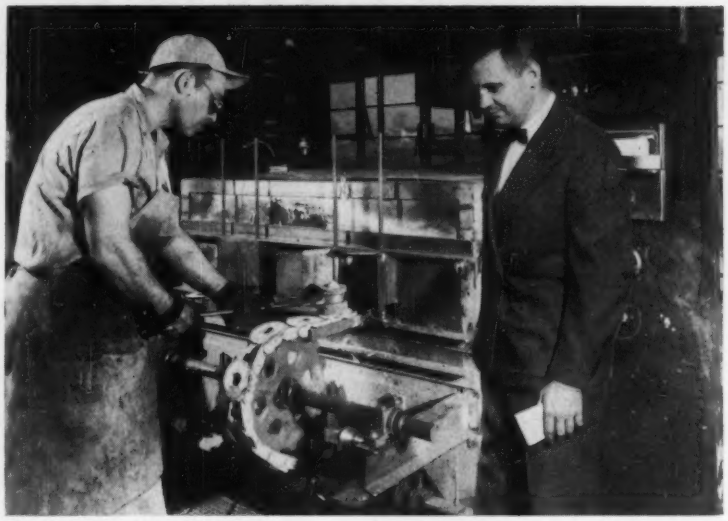


● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all other. Available two-way, three-way, four-way, and cone types. Write for facts.

AN EXCLUSIVE EVERSTICK FEATURE
Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO
Manufacturers of "THE ANCHOR OF MERIT"
FAIRFIELD, IOWA



THIS 33-KW ELECTRIC FURNACE cut rejects from 25% to 1% by preheating induction motor rotors to exact temperature before aluminum is cast into rotor slots

Newly Electrified Furnace . . .

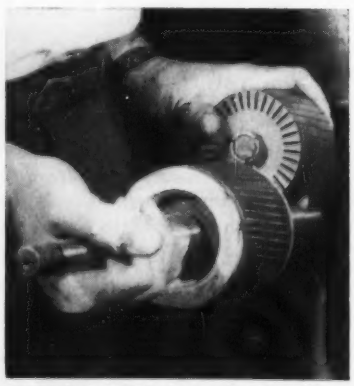
- Cuts rejects 95% through precise heat control
- Eliminates tie-ups using two new conveyors

G. H. HOFFMAN, Industrial Representative, Baltimore Gas & Electric Co, Baltimore, Md.

Rotors for induction motor components of Black & Decker Mfg. Co's quality line of bench grinders must meet such rigid specifications that about a fourth of them were being rejected during an aluminum casting operation. But these losses were reduced about 95% by a modernized, completely electrified furnace used to preheat the rotors before casting is begun. Now 99 out of 100 castings are perfect.

Slotted laminations make up the basic part of each rotor. These are aligned so molten aluminum can be poured into channels formed by the slots. Accuracy in the 33-kw preheating furnace is essential. Too low a temperature permits the aluminum to solidify before the slots are entirely filled. Too much heat holds the metal in a molten state so long that it spills over the top of the mold during a spin operation.

Formerly the preheating furnace had a tilted floor along which rotors rolled from the charge to the discharge end. Sometimes they jammed. In the redesigned furnace, nickel-chromium resistance heaters were placed in the bottom of the heating chamber and two air-operated conveyors were installed to carry rotors through the furnace. Preheated work is removed alternately from the conveyors to ensure uniform heating of rotors on both carriers. When the operator is ready to cast a unit, he steps on a treadle. A conveyor moves just far enough to bring one rotor from the furnace.



LEFT ARMATURE has been filled with aluminum, machined, and pierced by shaft

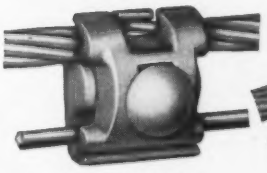
Reduce Inventory!

USE BLACKBURN'S PermaCad Aluminum Fittings

CHECK THESE PLUS FEATURES

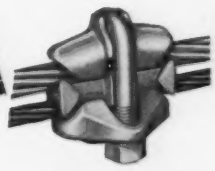
- All fittings may be used on either aluminum or copper conductors. Each fitting accommodates a wide range of wire sizes—few fittings are needed in stock or on trucks.
- Installation errors are eliminated on bi-metallic connections. Either groove will accommodate aluminum or copper conductors.
- Permacad fittings are available in one or two bolt parallel groove clamps—single and double U-bolt clamps. There's a fitting for every job.
- Grooves are contoured to surround conductor and provide large contact areas . . . improving conductivity.
- Non-copper-bearing, heat treated aluminum alloys used in all castings. Hardware available in either hot dipped galvanized steel or high strength aluminum alloy. Bolts alumilited to prevent seizing.

* **PERMACAD** *is a complex, heavy duty plating of cadmium and other metals which has exceptionally long life. PERMACAD protects aluminum because of its favorable electrogalvanic potential and is highly resistant to galvanic corrosion when in contact with copper.*

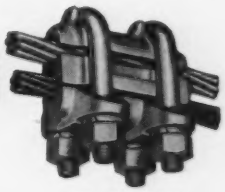


PGP SERIES
One bolt parallel groove clamp. Three fittings accommodate wire ranges from 8 AWG to 397.5 MCM.

PGP 400 SERIES
Two bolt parallel groove clamp. One clamp accommodates conductors from 1 str to 400 MCM.



DLC GP SERIES
Single U-bolt clamp. Four clamps accommodate wire range from 6 AWG to 266.8 MCM.



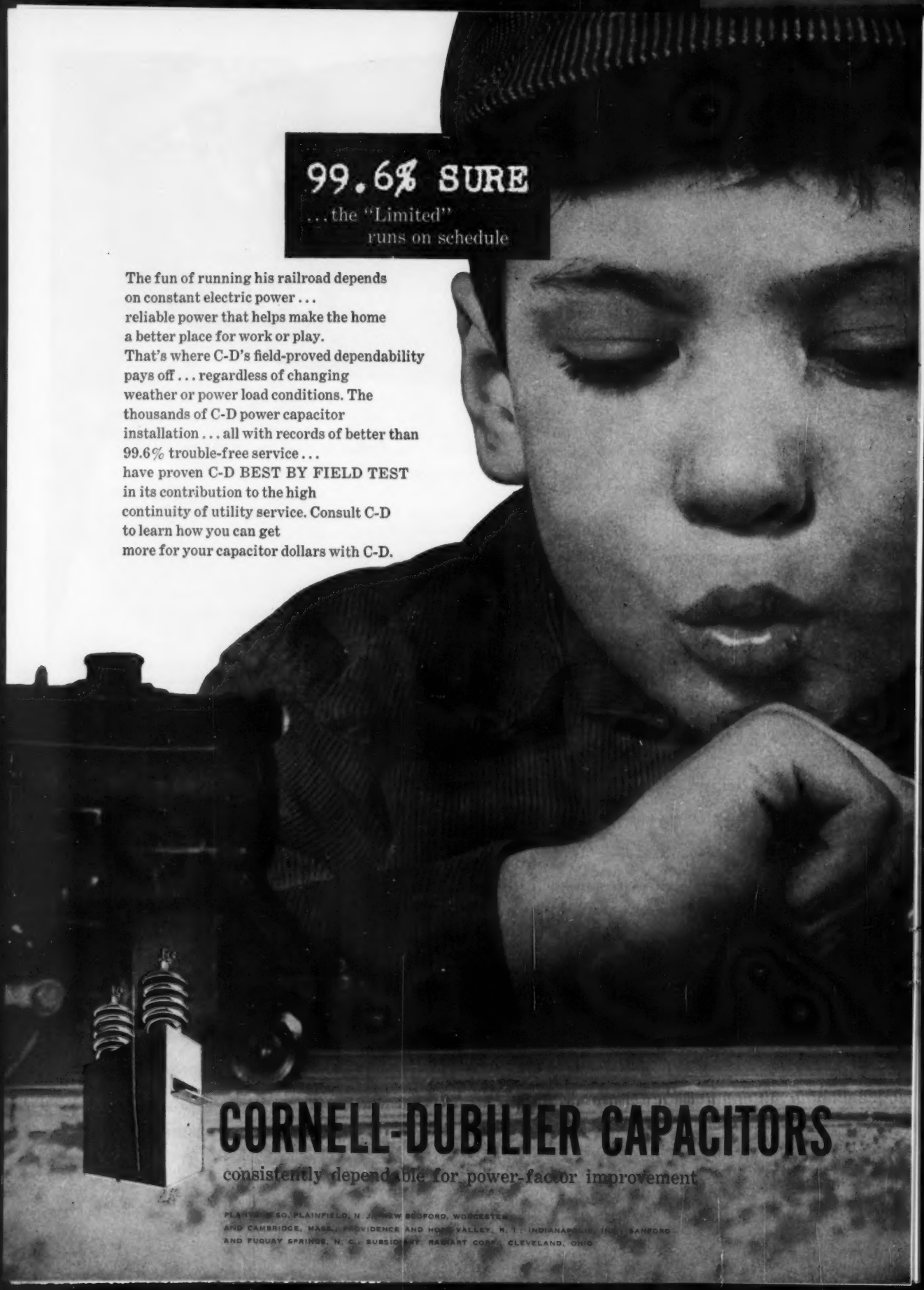
2U GP SERIES
Double U-bolt clamp. Six clamps accommodate conductors from 1 str to 397.5 MCM.

BLACKBURN PermaCad FITTINGS

IMPORTANT: We recommend the use of CONTAX on all aluminum and bi-metallic connections. CONTAX is an oxide inhibiting compound with an ASTM drop point in excess of 500° F.

AVAILABLE THROUGH ELECTRICAL DISTRIBUTORS EVERYWHERE

JASPER BLACKBURN CORPORATION
35 MADISON ST. • ST. LOUIS 6, MO. • PHONE MAIN 1-2821


99.6% SURE
...the "Limited"
runs on schedule
The fun of running his railroad depends
on constant electric power...
reliable power that helps make the home
a better place for work or play.
That's where C-D's field-proved dependability
pays off... regardless of changing
weather or power load conditions. The
thousands of C-D power capacitor
installation... all with records of better than
99.6% trouble-free service...
have proven C-D BEST BY FIELD TEST
in its contribution to the high
continuity of utility service. Consult C-D
to learn how you can get
more for your capacitor dollars with C-D.
CORNELL-DUBILIER CAPACITORS
consistently dependable for power-factor improvement
PLANTS: S.E.60, PLAINFIELD, N. J.; NEW BEDFORD, WORCESTER
AND CAMBRIDGE, MASS.; PROVIDENCE AND HOPE VALLEY, R. I.; INDIANAPOLIS, IND.; SANFORD
AND FUQUAY SPRINGS, N. C.; SUBSIDIARY, RUGART CORP., CLEVELAND, OHIO

CORNELL-DUBILIER
power-factor
capacitors
give you better than 99.6%
trouble-free service*

C-D's power capacitor's major insulation establishes impulse levels that exceed N. E. M. A. standards. Another feature that results in longer life . . . less maintenance . . . fewer dissatisfied power-users, with Cornell-Dubilier capacitors.

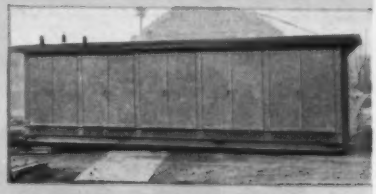
C-D capacitors, although somewhat larger and heavier, have an extra built-in margin of safety to withstand occasional system high harmonic component currents.

Heavy major insulation in the form of laminated liners, with reinforced corners insures highest impulse withstand levels. It means, too, a heavier capacitor unit . . . because it's a better unit . . . but at no extra cost to you. How would you relate a slight increase in weight to years of trouble-free service?

Lowest unit dielectric stress not only provides lowest voltage gradient for steady state operating conditions, but also highest withstand protection against the transients produced by lightning, circuit breaker re-strikes and all other line surges.

Why is it that only C-D power capacitors give you assurance of complete dependability?... because C-D's built-in safety factor results from the ultimate in tried and proven design levels coupled with conservative production techniques and rigorous quality control. For catalog write to Cornell-Dubilier Electric Corporation, South Plainfield, N. J.

Typical C-D Indoor Capacitor Rack. Rated 150 KVAR; 12 KV.



Typical C-D Outdoor Capacitor Rack shipped completely assembled ready for field energization. Rated 5,400 KVAR; 13.8 KV.

***This is an average based on reports from leading utilities using C-D capacitors. Many of these reports have shown 100% trouble-free service, and none lower than 98.9%.**

INDUSTRIAL BRIEFS

Preventing ice from covering the log pond at Novosel Lumber Co, Kane, Pa., is done with six electric immersion heaters totaling 66 kw. Replacing a steam-boiler system, the heaters maintain the 60 x 30 x 5-ft pond at 40F even on the coldest winter day, when the outdoor temperature dipped to –24F. Operating records show this installation costs less than the labor, operating, and maintenance expenses of the discarded steam system. It also cuts insurance costs for the lumber company by eliminating a possible fire hazard. Cherry and maple logs are dumped into the pond to wash off loose bark and dirt, and to soak so they will be easier to saw. In winter, the pond's water must be warmed to 40F to thaw out the logs.—W. F. Hutchins, Industrial Power Engineer, West Penn Power Co, Ridgway, Pa.

Releasing 300-lb ice cakes from cans in which they froze now is done at Peoples Artificial Ice Co, Shenandoah, Pa., by spraying the cans with water from an 80-gal electric water heater. Formerly cans were dunked in a concrete well filled with water. In the summer, when this water was above 70F, the process worked well, but in winter, when the water was 45F or lower, trouble was experienced. The new arrangement has reduced processing time 30% with little investment in special equipment. N. O. Clemens, Industrial Representative, Pennsylvania Power & Light Co, Pottsville, Pa.

Preventing water from freezing in air conditioning cooling towers not used during winter has been accomplished electrically in many buildings in downtown Wichita Falls, Texas. The intake and discharge pipes are plugged and drained, and immersion heaters are installed in the cooling tanks. This enables the tanks to remain filled year-'round, thus cutting the water bill and reducing maintenance costs. The job is done effectively with little heat—just enough to prevent ice from forming. In one case, a 10,000-gal tank required only three 800-w units, all connected to one submerged water thermostat set at 31F. Harold E. White, Sales Engineer, Texas Electric Service Co, Wichita Falls, Texas.

For a Really Safe

It takes 3 tanks

Even a Small Outdoor Breaker should have Tank-Per-Phase Construction

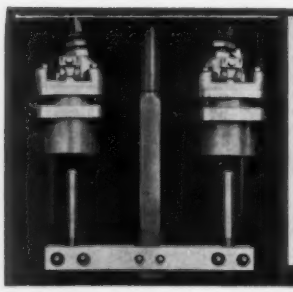
Don't be ⅓ safe! It costs you no more to get the complete safety of 3-tank breakers.

Compare this breaker with others of the same rating, and see the difference. Here's a small outdoor breaker built with big breaker features:

- Tank-per-phase construction completely isolates phases to eliminate internal phase-to-phase flashover.
- Two vertical breaks per phase with time-proved, fully tested *Ruptor* interrupting devices.
- Roomy operator cabinet with side-hinged L-shaped doors for maximum accessibility.

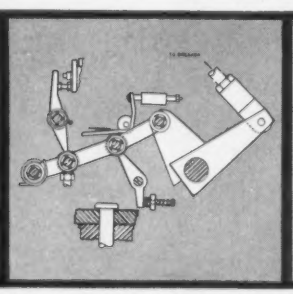
There is no other breaker for 14.4 and 23-kv service that compares with this breaker for safety, ease of maintenance and overall accessibility. It's *quality* throughout.

GET INFORMATION and make your own comparison. Call your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin. A-4933



Two vertical internal breaks per phase . . . features time-proved, fully tested *Ruptor* interrupting devices with self-wiping, self-aligning tulip and bayonet contacts.

No buried leads. No more conduits . . . no dropping of breaker tanks to get at bushing current transformer leads. Simply remove bottom cover plate of fabricated wiring duct.



Four-bar linkage like ones on large A-C breakers provides mechanically trip-free operation. Simple solenoid operator — factory-set shim adjustments cut maintenance.

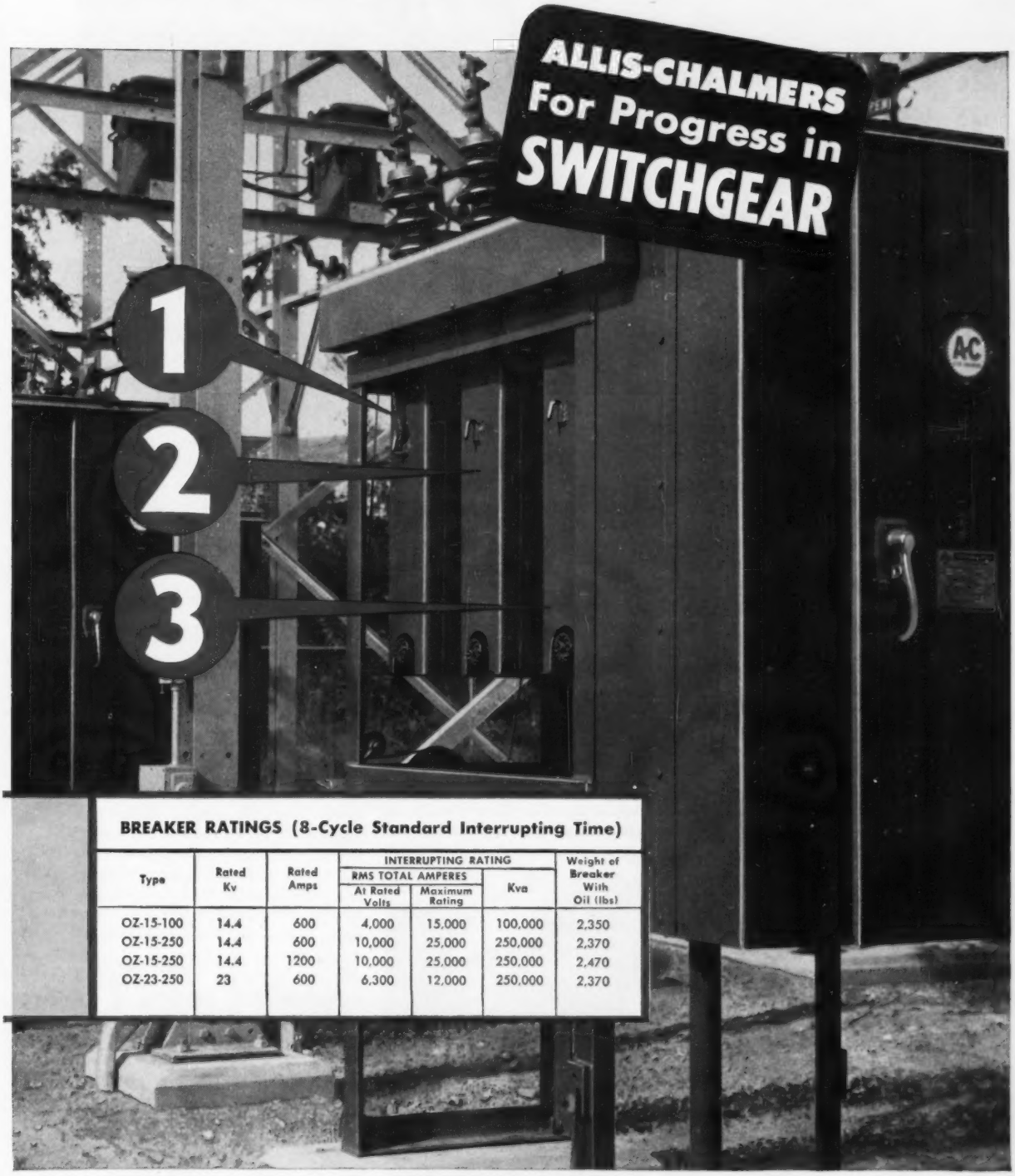
Eight-page bulletin 71B7946 tells the complete story. It shows the many quality features ordinarily found only in the larger breakers built into these units.

A-C ALLIS-CHALMERS

Ruptor is an Allis-Chalmers trademark.

ALLIS-

Distribution Breaker . . .



BREAKER RATINGS (8-Cycle Standard Interrupting Time)

Type	Rated Kv	Rated Amps	INTERRUPTING RATING			Weight of Breaker With Oil (lbs)
			RMS TOTAL AMPERES		Kva	
			At Rated Volts	Maximum Rating		
OZ-15-100	14.4	600	4,000	15,000	100,000	2,350
OZ-15-250	14.4	600	10,000	25,000	250,000	2,370
OZ-15-250	14.4	1200	10,000	25,000	250,000	2,470
OZ-23-250	23	600	6,300	12,000	250,000	2,370

CHALMERS

To Sell Commercial Cooking . . .

Detroit Edison Takes Kitchen to Prospect's Door

A KITCHEN ON WHEELS, Detroit Edison Co's 'Chef Liner' had 1,238 visitors during maiden 2-month tour

L. E. TAYLER, Director of Commercial Sales, Detroit Edison Co, Detroit, Mich.

One selling fundamental not to be overlooked is "Make it easy for the customer to buy."

When a field check revealed, though, that Detroit Edison Co's suburban food service customers weren't finding it too easy to discover advantages of electric cooking, it posed some problems. How do you interest prospective buyers who can't afford the commuting time to view downtown cooking demonstrations and open houses? How do you promote business where food service dealer coverage is understandably thin?

The solution? Take a demonstration of the advantages to the customer's doorstep.

In 1955, the company converted a motor coach into a traveling commercial kitchen and christened it the "Chef Liner." On a two-month tour last fall, it journeyed to 24 of the company's outlying offices serving much of its 7,600-sq mile suburban area.

A total of 1,238 people saw, tried for themselves—and tasted—electric cooking advantages. In general, interest was high. Many indicated their intention to purchase certain items, especially the deep fat fryer. And many who prepared food electrically for the first time erased false impressions on cooking speed and convenience.

The prospects, consisting mostly of restaurant owners, club managers, and institutional dieticians, learned of Operation Doorstep by two direct mail pieces. The first was a general announcement; the second, a ticket telling where and when the Liner would stop for demonstrations.

"Chef Liner" cooking equipment includes two fry kettles, two griddles, a food warmer, range, coffee maker, and toaster. The wiring allows energizing most of the cooking devices. The coach has plumbing and water connections so that, by installation of a 50-gal electric water heater and a sink, utensils and equipment can be kept clean. An under-the-counter refrigerator permits ample food storage space. Ultra-violet germ-kill lamps and two ozone lamps are connected and operated during the tours. Total electric load, including water heater and refrigerator, is 16 kw.

Besides actual cooking demonstrations and descriptions of available equipment, a portfolio of kitchen installation photographs gave visitors a complete picture, always, of course, with the help of a good cup of coffee.

The application of the axiom, "Make it easy for the customer to buy," constantly reminded all those concerned with the "Chef Liner" tour to continue Operation Doorstep.

(*More S & S on page* 144)

DIRECT MAIL SEND-OUTS announce when and where the 'Chef Liner' stops in its circuit of suburban offices. Busy food service customers get facts at their doorstep

VICTOR PROGRESS REPORT 2

We make our own LIGHTNING to give you INSULATORS that last

Shown above is VICTOR'S 800,000-volt impulse generator in our modern electrical laboratory. This unit, together with VICTOR'S complete mechanical and electrical test facilities, enables our engineers to simulate the most extreme service conditions.

Included in this unit are a remote controlled gap spacing mechanism, an oscillograph for showing wave forms visibly on the screen of a cathode ray tube and a 4″ x 5″ camera for recording these waves on film for observation and study.

One more reason why VICTOR gives you insulators that last—that are design-tested to withstand lightning and other adverse service conditions. VICTOR'S modern plant, engineering and research facilities are unsurpassed in the field. You just can't buy better insulators!

"BETTER INSULATORS THROUGH RESEARCH"

SPECIFY VICTOR Purified Porcelain Insulators!

VICTOR INSULATORS DIVISION
I-T-E CIRCUIT BREAKER CO.
VICTOR, N. Y.

Low and High Voltage Pintypes • Suspensions • Guy Strains
Spools • Switch and Bus Insulators • Custom Designed Porcelain
Insulator Hardware

HE CAN'T STAND PEOPLE TALKING ABOUT HIM!

That's why Kennecott is telling the world about SKIMPY WIRING!

Left to his own devices, this obnoxious Skimpy Wiring character can wreak no end of havoc on the electrical business. His small, weak wires and inadequate circuits mean a dead end for power sales in more than 80% of the homes in your territory!

Fortunately, Skimpy Wiring is vulnerable. He simply cannot stand the limelight! Once folks recognize him, and realize that he is the cause of most of their electrical troubles, Skimpy Wiring is well on his way out!

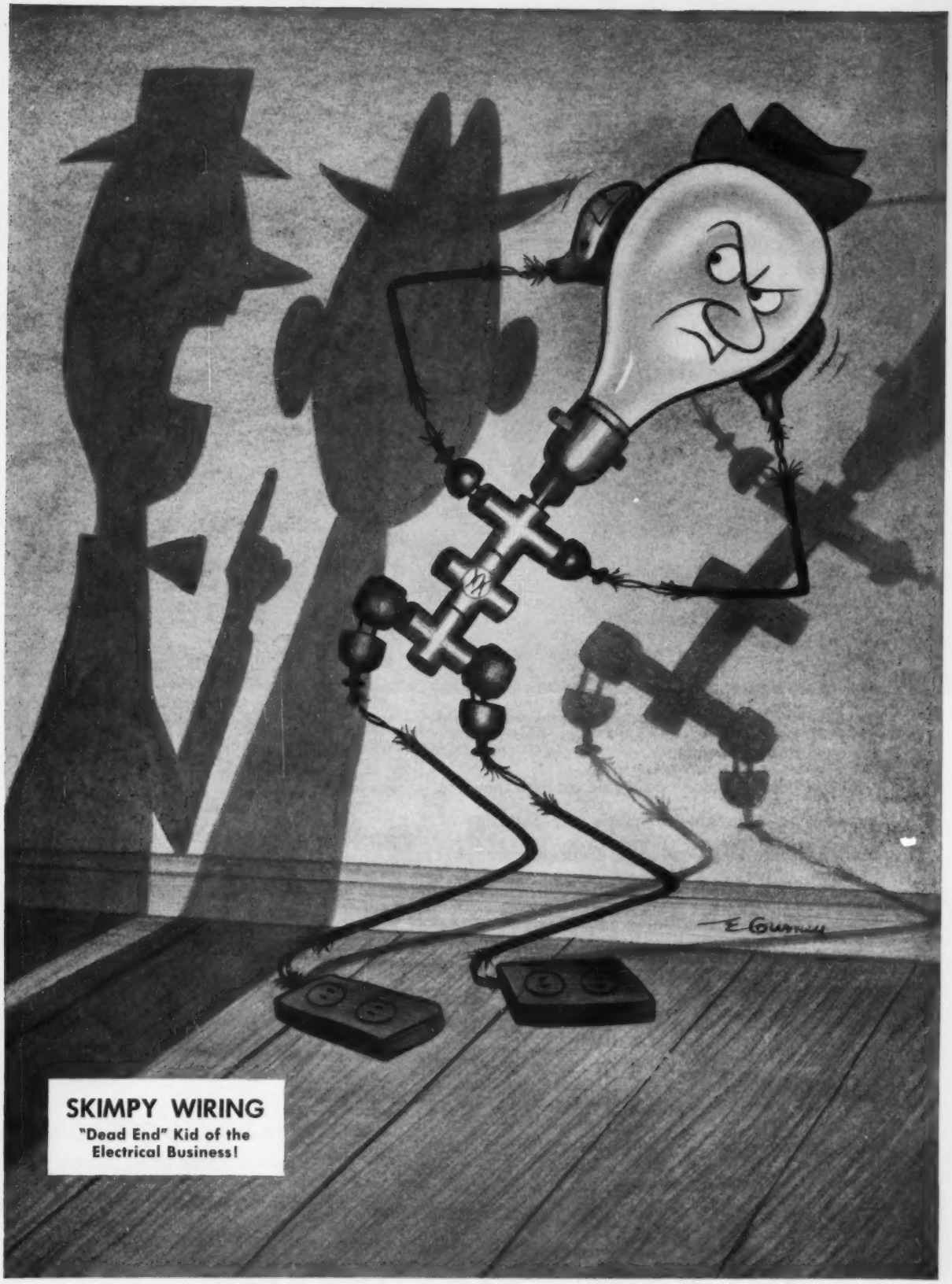
That's why Kennecott is running ads like the one shown below — to put the finger on Skimpy Wiring and to show homeowners how to get rid of him! Designed to aid the entire electrical industry, this Kennecott campaign can add new life to your own local adequate wiring promotions, can boost the sale of power right in your own area!

FREE! PROMOTIONAL MATERIAL!

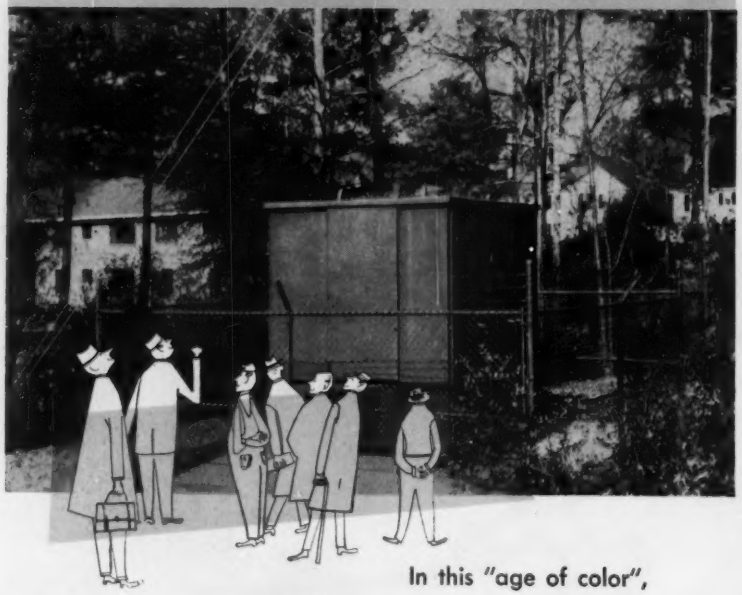
Send today for reprints and poster-sized blow-ups of Kennecott's full-page Saturday Evening Post and This Week Magazine ads. Ask for "The ABC of Home Wiring"— Kennecott's educational, 16-page booklet. Get the free Kennecott Home Wiring Wall Chart, mat service folder and list of *at-cost* prices for quantity orders of all available material. Write Kennecott Copper Corporation, Dept. W42, 161 E. 42nd St., New York 17, N. Y.

Kennecott Copper Corporation

Fabricating Subsidiaries: CHASE BRASS & COPPER CO. • KENNECOTT WIRE & CABLE CO.


SKIMPY WIRING
"Dead End" Kid of the
Electrical Business!

CORROSION PROTECTION PLUS GOOD LOOKS



In this "age of color", managements are sensitive to the need for paint that is both anti-corrosive and decorative. Paint should not only preserve plant and equipment, it should also preserve the good will of neighbors and the enthusiasm of personnel.

Subox* and Subalox* paints do all this. They are the only paints in America made with Suboxide of Lead, therefore they provide excellent corrosion protection. And they are made in a wide range of metallic colors, and are effective indoors as well as outside.

Subox paints offer a complete paint system. Often the same variety functions as both primer and finishing coat and may even answer the need for reflectivity as well as radiation.

Send for color cards and data book "Subox Paints".

*Trade Mark

Subox Inc.

Established 1924
3 Fairmount Plant, Hackensack, N. J.

See Catalogues in Sweet's Industrial and Engineering Files

LBE Reports

. . . from California utilities are optimistic; Massachusetts company offers wiring plan

• "Grass roots" breakfast meetings in its 30 districts keynoted Southern California Edison Co's initial Live Better . . . Electrically push. About 2,500 electrical industry businessmen saw a kinescope of the closed-circuit LBE telecast, heard how they could tie in with utility's broad program. Response is gratifying, company says.

• Widespread publicity, upsurge of electric appliance installations were noted by Los Angeles Dept of Water & Power after LBE opening. Building publications featured the February 8 telecast which was attended by 601 guests.

• One Western Massachusetts Electric Co tie-in with LBE is granting rewiring allowances for installation of 100-amp, three-wire service. Single family dwelling gets $20; two-family, $40; three-family, $60; and larger apartments get allowances through consultation.

Farmers to Buy More

More than three-fourths of appliance dealers in eight largest farming states expect higher sales this year over 1955, says Midwest Farm Paper Unit survey which also found TV sets, freezers, automatic washers highest on farmers' plan-to-purchase lists.

Rural Kansans are budgeting $15 million for appliances according to Kansas Inter-Industry Farm Electric Utilization Council survey of 10,736 families.

Fixture Sales Up 25%

Residential lighting fixture sales hit an estimated $77 million last year, 25% higher than 1954, American Home Lighting Institute reports. It expects a 12% increase in 1956 for a sales volume of $86 million.

J. E. Barkle compares the old and new cover designs for distribution transformers. New, simplified, single-bolt cover eliminates four clamps, speeds maintenance, seals tighter.

Simplified equipment that offers system-wide economy

Today, economy in system operation is a major concern of the electric utility industry. Spiraling costs of labor and materials pose a definite threat to established rates of return on invested capital.

Our role in your cost campaigns is this: To lower the expense of installing, operating and maintaining Westinghouse apparatus—by simplifying product design. This work has been carried forward at all engineering levels, from materials research to product design, development and testing.

On the following pages, J. E. Barkle, Manager Electric Utility Industry Engineering, will report some of the outstanding achievements in this program of product design simplification—and the resulting benefits to you in economy of system operation.

YOU CAN BE **SURE**...IF IT'S Westinghouse

Bob Wagner, Distribution Equipment Sales Manager, and the new 50-kva "CSP" distribution transformer now rolling off production lines of the Sharon, Pennsylvania, plant.

COST BREAKDOWN	CONVENTIONAL	"CSP"
I INITIAL COST		
Transformer (Class A, 5 KV, 25 KVA)	$284.50	$326.50
Crossarm (1)	4.00	——
Lightning Arrester (2)	17.94	——
Fuse Cutout & Fuse (2)	31.66	——
II INSTALLATION COST*		
Mounting Transformer (1)	17.32	17.32
Mounting Crossarm (1)	2.70	——
Mounting Arresters (2)	5.38	——
Mounting Cutouts & Fuses (2)	5.42	——
Total Investment	$368.92	$343.82
III MAINTENANCE COST* (ANNUAL)		
Burnouts (Replacement Cost)	$ 2.25	$ .58
Fuse Outages	.52	——
Load Surveys	1.60	——
Resetting of Light or Breaker	——	.08
IV AMORTIZATION & INVESTMENT COST		
Interest on Investment (4.62%)	17.04	15.88
Amortization (4.27%)	15.75	14.68
TOTAL ANNUAL COST	$ 37.16	$ 31.22

*Figures based on national averages.

This chart demonstrates the lower total cost of a "CSP" transformer installation compared with a conventional installation of the same rating (25 kva).

"Let's start with two outstanding examples of simplified designing — 'CSP' transformers and MAGAMP regulator controls. Bob Wagner and Gil Anderson tell the stories."

"CSP®" transformer cuts all 4 cost factors

The famous Westinghouse "CSP" distribution transformer *is* system economy—and here, on this page, are the figures to prove it.

The reason is simple: The "CSP" transformer is a complete pole-top package. No separately mounted arresters, fuses, cutouts, or extra crossarms are necessary —"CSP" has all protective equipment built in.

The sheer simplicity of this arrangement saves you a great deal of money when you figure in the total of *all four* factors of transformer cost.

Initial Cost—The delivered cost of the "CSP" transformer is about the same as the corresponding conventional transformer and its separate equipment.

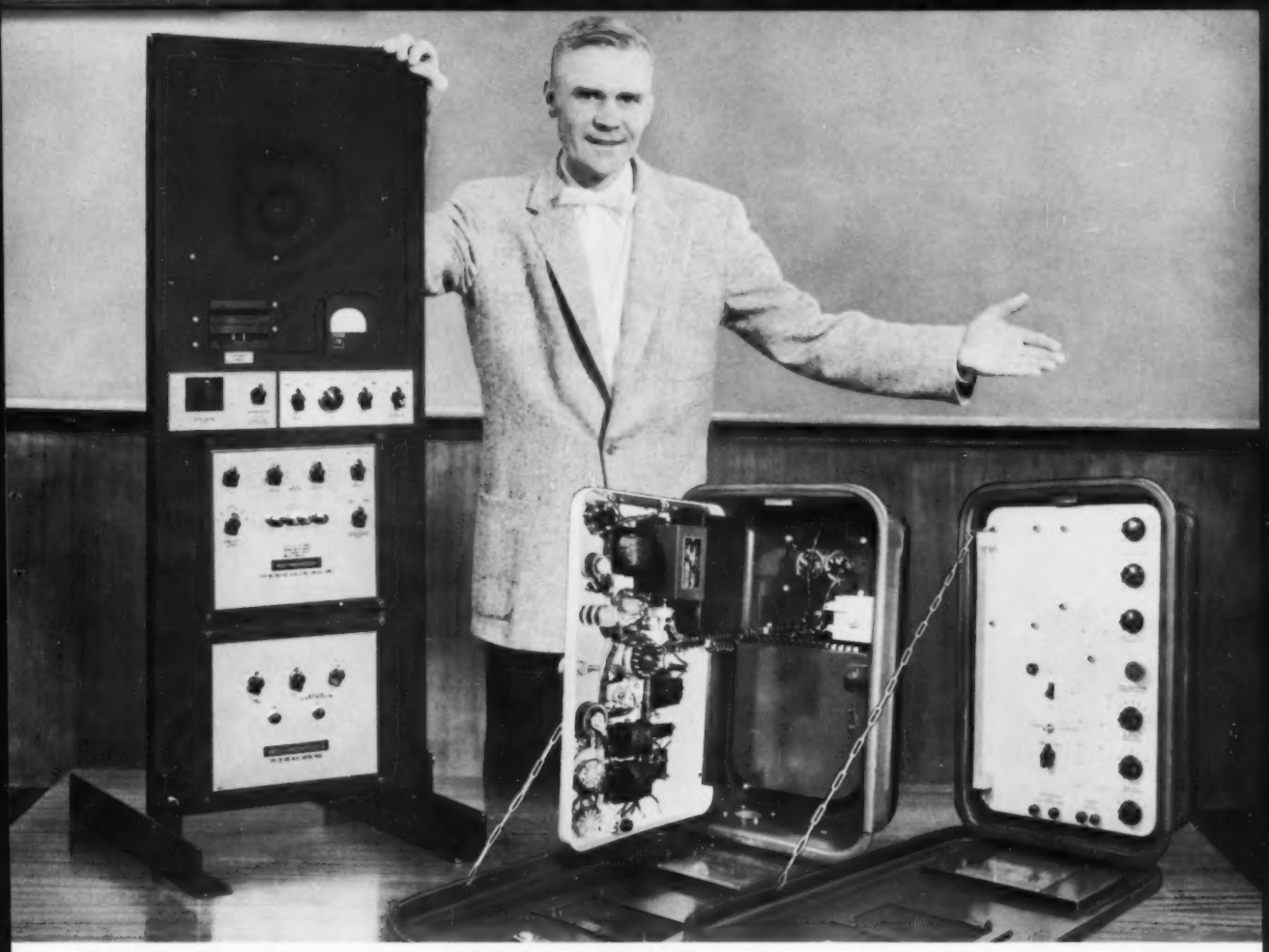
Installation Cost—The "CSP" transformer saves you *all* the cost of installing separate arresters, fuse cutouts, fuses and extra crossarms (if used).

Maintenance Cost—"CSP" transformer eliminates fuse and cutout replacements, burnouts and expensive load surveys.

Amortization Cost—The lower total cost of "CSP" transformer installation means lower interest and depreciation costs on your investment.

The figures prove it—utility acceptance confirms it: No distribution transformer saves you more—or serves you better—than a Westinghouse "CSP". Get the facts on the great new 1955 "CSP" transformer from your Westinghouse sales engineer.

YOU CAN BE **SURE**...IF IT'S



Gil Anderson, Voltage Regulator Sales, points out the two sealed MAGAMP units in the SU induction regulator control. On the left is the MAGAMP control for the URS and URT station step regulators.

Completely static MAGAMP* control slashes regulator maintenance cost

In terms of your system maintenance, think what a *completely static* regulator control can mean! No moving parts to jam, stick or get out of alignment—no contacts to dress—nothing to wear out or replace. All "routine" maintenance, in fact, eliminated.

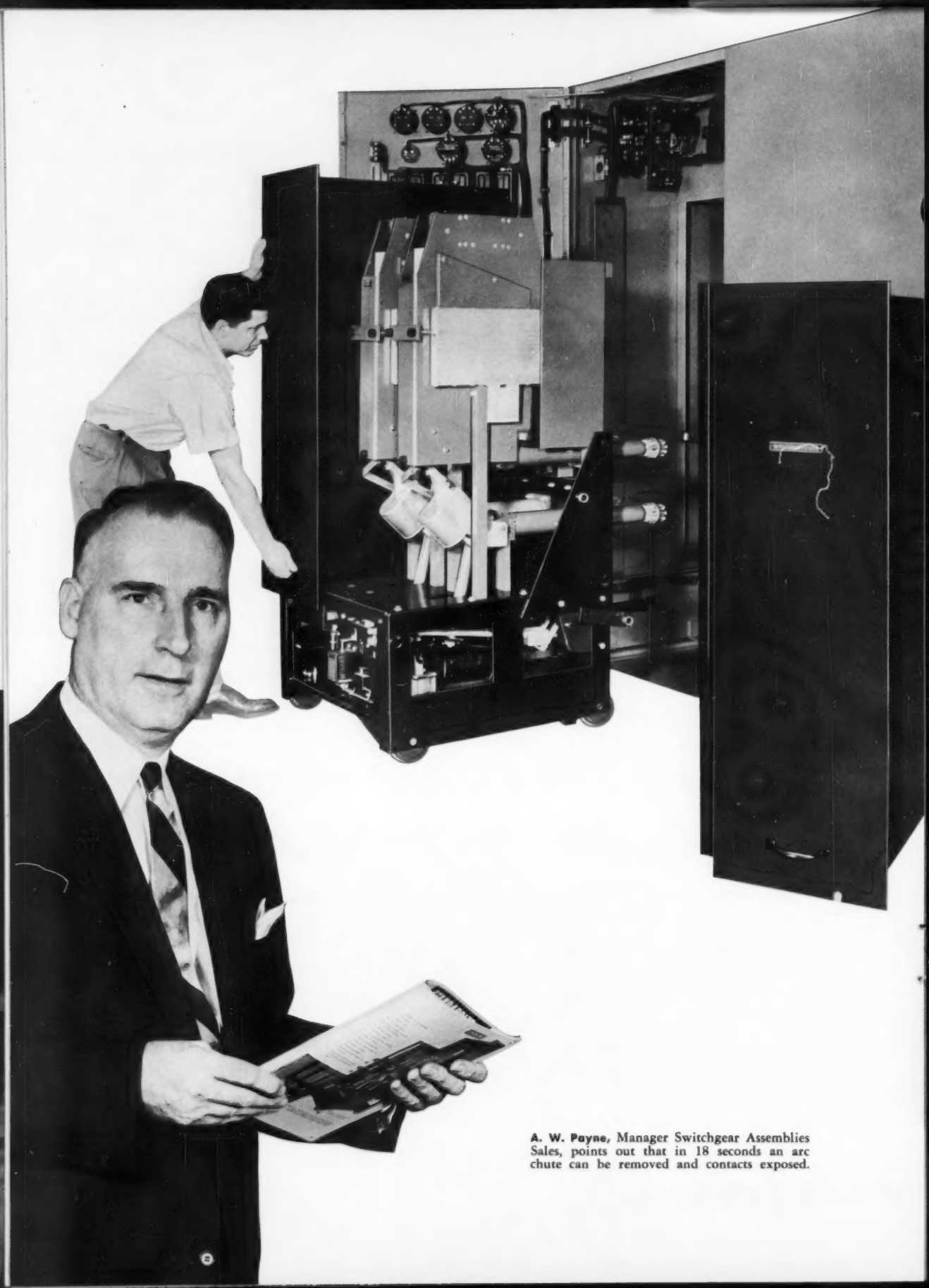
This control is a reality—it is available *now* on all Westinghouse single-phase induction regulators. This revolutionary MAGAMP (magnetic amplifier) control ushers in a new era of maintenance-free reliability—and thus economy—in voltage regulator operation.

The new Westinghouse SU and SI induction regulators have MAGAMP devices in both the voltage-sensing and motor-operating portions of the control circuit. They are completely static, sealed units—function through electrical control components that provide ASA Class 1 accuracy.

Westinghouse URS and URT station step regulators gain the maintenance-saving advantages of MAGAMP control, too. Both the Type MS voltage-regulating control and the Type TM time-delay control use a completely static, sealed MAGAMP unit. The time-delay control operates two motor contactor auxiliary relays, which have a proved life of well over 25 million operations—with no maintenance.

* Trade-mark

Westinghouse



A. W. Payne, Manager Switchgear Assemblies Sales, points out that in 18 seconds an arc chute can be removed and contacts exposed.

"**Wally Payne** says that metal-clad switchgear can be easily, inexpensively maintained—if it's Westinghouse."

Accessibility is key to economical maintenance of metal-clad switchgear

Maintenance of Westinghouse switchgear is economical simply because it takes less time . . . time required to get to components, time to inspect or replace parts, time in putting equipment back to work. All parts are readily accessible. This is so because standardization has simplified both the design and operation of Westinghouse metal-clad switchgear.

As an example, let's look at circuit-breaker servicing. Breakers are drawn out horizontally on wheels . . . no lowering or lifting necessary. Interphase barriers are quickly removed by loosening bolts and sliding barrier forward. Remove arc chutes in the same manner, and contacts are exposed.

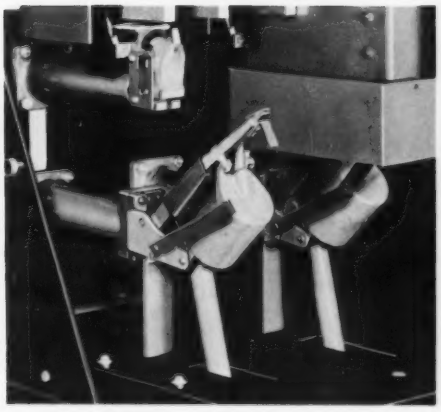
Contact operation may be checked by opening and closing contacts manually. Minor maintenance may be handled on the spot without further disassembly. If more extensive work is called for, the breaker may be replaced as quickly as it was removed . . . Westinghouse breakers are interchangeable.

All this is done with perfect safety, too. Each compartment is completely isolated from line parts in adjoining compartments by full steel barriers. When the breaker is in "test" position, the metal shutter closes to isolate the stationary primary disconnecting contacts. If breaker closes, an interlock prevents moving breaker between operating and test positions.

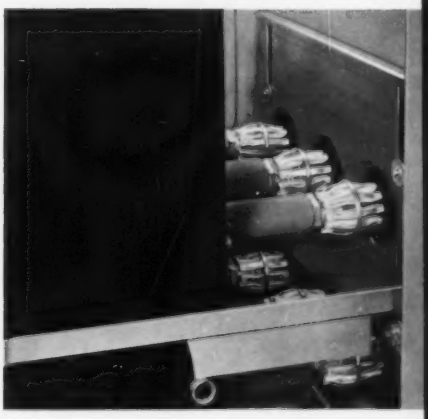
Altogether, fewer maintenance headaches, less costly operation, greater service continuity are what you buy in Westinghouse metal-clad switchgear.

YOU CAN BE **SURE**...IF IT'S
Westinghouse

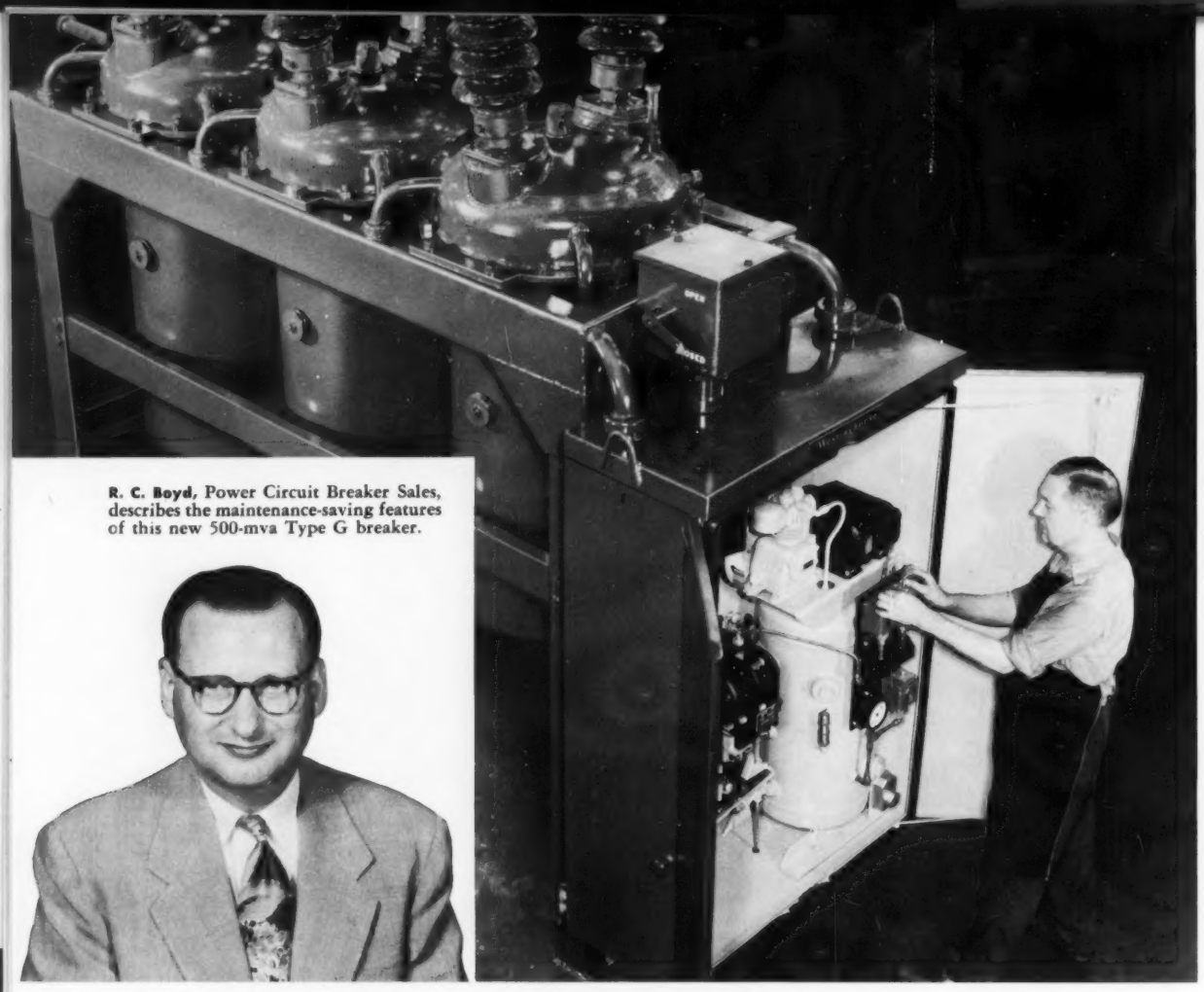
Two bolts, right in front, are all that need be removed to disengage arc chute which is easily handled.



Contacts are at convenient working height, and may be dressed without complete disassembly.



Moving primary disconnects engage with stationary contacts behind protective shutter which opens as breaker is rolled into operating position.



R. C. Boyd, Power Circuit Breaker Sales, describes the maintenance-saving features of this new 500-mva Type G breaker.

Redesign of frame-mounted breakers cuts maintenance time one third

Easier maintenance is the big news in the redesigned Westinghouse frame-mounted breakers. Due largely to the ASA-NEMA standardization program, breakers rated 500 mva and up have been greatly simplified, and now offer you these dollar-saving advantages:

- New ASA standard bushing—now completely interchangeable, bushing has shielded tap for easy power factor testing without removal from the breaker.
- Deep-drawn steel top eliminates lever box and inaccessible surfaces; simplifies cleaning, painting.
- Weatherproof trough carries transformer leads to mechanism housing. Removable cover plate makes wiring and terminal blocks easily accessible.
- Thread cleaning and painting are materially reduced through elimination of conduit and condulets, and the use of dresser fittings.
- Extra ground sleeve length of the bushing and improved current transformer mounting. Two standard current transformers per bushing may be mounted.
- No diagonal braces except on 69-kv breakers; tanks are now more easily removed from under the frame.

The bargain in Westinghouse breakers doesn't end with easier maintenance—installation is quicker, easier; appearance is neater, more attractive.

"In high-voltage interrupting and disconnecting equipment, simplicity of design means greater reliability and easier maintenance. Bob Boyd and Wilbur Pyle from Switchgear explain why maintenance of Type G breakers and Type V switches is so easy—costs so little."

Strength, simplicity of design are clues to maintenance-free switches

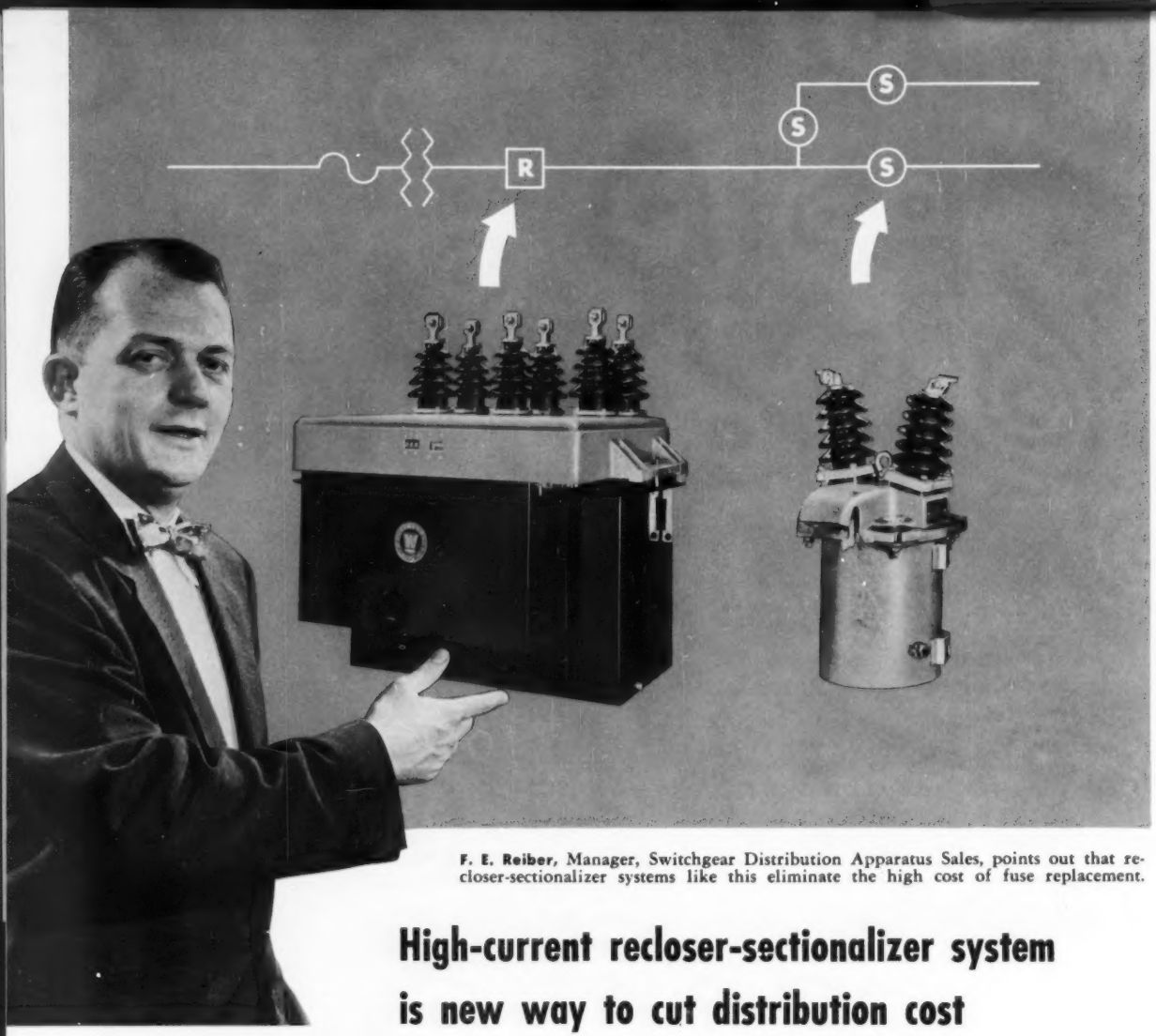
Sheer durability and simplicity of design are your two best assurances of a lifetime of service and a minimum of maintenance with Westinghouse Type V disconnecting switches. Here are five exclusive features calculated to give you the most foolproof switch available anywhere:

1. Oilite bushings on all live side loaded bearings, up to 23 kv, provide permanent lubrication.
2. Above 23 kv, stainless steel ball bearings hold rotating insulators rigidly in position; lubricated for life.
3. Only three moving parts virtually eliminate wear or fouling under any operational or weather condition.
4. Opposing contacts, made of alloys of unlike hardness, eliminate galling.
5. Streamlined, high-strength, copper-alloy housings shaped to minimize corona formation and protect the mechanism from dirt and corrosion.

Maintenance-free reliability is built into every Westinghouse switch —a fact that has been proved in service for many years.

Wilbur Pyle, Sales Manager, Switchgear Devices, points out the Oilite bushings on this 15-kv Type V switch

YOU CAN BE **SURE**... IF IT'S Westinghouse



F. E. Reiber, Manager, Switchgear Distribution Apparatus Sales, points out that recloser-sectionalizer systems like this eliminate the high cost of fuse replacement.

High-current recloser-sectionalizer system is new way to cut distribution cost

The new Westinghouse 400-amp power recloser is a high-capacity, low-cost package designed to protect substations and main feeders through 15 kv. In combination with the recloser, the GRS sectionalizer, rated 5 to 140 amperes, trips after two or three recloser openings. These new products, working together, are a new approach to distribution system protection.

Here are outstanding benefits you get:

1. Low first cost—less expensive than alternative fault protection equipment.
2. Low installation cost.
3. Low system operating cost—high-speed recloser clears all temporary faults; sectionalizers open only on permanent faults, reducing outages and trouble crew travel time. Sectionalizers interrupt no fault current—minimum maintenance.
4. Flexibility—recloser tripping adjustments are easily made in solving load growth and cold-load pickup problems.
5. Dependability—sectionalizers have no time-current curves, give perfect coordination with minimum engineering.
6. Line maintenance is safer, easier—sectionalizers are safe load-break switches.

Consider the power recloser and high-current sectionalizer combination in planning your next distribution system. Call your Westinghouse sales engineer, or write Westinghouse Electric Corp., Box 868, Pittsburgh, Pa.

YOU CAN BE **SURE**...IF IT'S Westinghouse

CP1035

$5 per Kw Bonus...

. . . sells electric space heating for Washington co-op; helps it keep track of new jobs

A bonus plan of $5 per installed kw has been used to introduce electric space heating to customers of Orcas Power & Light Co, Eastsound, Wash. The electric cooperative serves principally residential and small farm customers on the San Juan Islands in the Strait of Georgia between Washington and Vancouver Island.

These were the requirements to qualify for the bonus:

- Equipment had to be purchased and installed within the bonus period which started last October and ran until April.
- Equipment must be UL approved, require 240 v, and be thermostatically controlled. Not more than 3 kw may be controlled by one thermostat.
- It must be installed in buildings constructed for year-round use which will be occupied not less than six months annually. Equipment for an entire building or for partial heating was eligible for the bonus offer, however.
- Wiring must be permanent and must be passed by an electrical inspector.
- Service entrance must be large enough to provide adequate capacity.
- All installations must be inspected and confirmed by the utility's representatives.

In advertising the bonus, Orcas P&L recommended that customers insulate and weatherstrip the building. It also offered help in planning the heating installation and provided estimates on operating costs.

Annual Return of $120

Orcas estimates an average home heating job of 12 kw will consume about 12,000 kwhr annually. At 1¢ per kwhr, this should return $120 annually against a bonus of $60. In just the first month of the plan, six complete home heating jobs were installed.

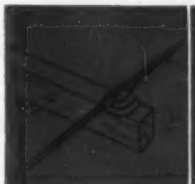
Because electric heating is relatively new to the area, the utility preceded announcement of the plan with a one-day school for builders, equipment dealers, and electricians. Manufacturers' representatives briefed them on sales points and how to calculate installation and operating costs under

(*Continued on page* 154)

FANNER *Superformed* **LINEGUARDS provide lowest cost protection on SHORTSPAN CONDUCTORS**

Fanner Superformed LINEGUARDS give short span distribution lines complete protection against abrasion, arcover, or clamp or tie wire damage at lowest possible cost. They have the same features of ease of installation, lasting durability and reuseability as Fanner ARMOR RODS, but are smaller in wire size and shorter, therefore cost far less: It's good economy to use Fanner LINEGUARDS on short spans with low tensions (1) at support points to protect against clamp or tie wire damage, (2) to provide a protective layer for tapping purposes, (3) at expulsion-gap or other critical locations. Further information and prices on FANNER Superformed Lineguards will be furnished on request. Write today.

Other FANNER ELECTRICAL LINE PRODUCTS

ARMOR RODS	PATCH RODS	TAP ARMOR	PLASTIC FANNGUARDS
			
• For protection against vibration damage and also good for emergency repairs on partially broken overhead lines.	• Act as a "repair sleeve" for conductors having up to about ¼ of the wires broken in the outer layer.	• Provides a protective layer of shortened rods on conductor for making taps without risking damage to conductor.	• Tough, durable spiral wound plastic sleeves that snap together over covered wires and cables to provide protection against tree abrasion.

Licensed for use under Patent No. 2,275,019

THE FANNER MANUFACTURING CO.

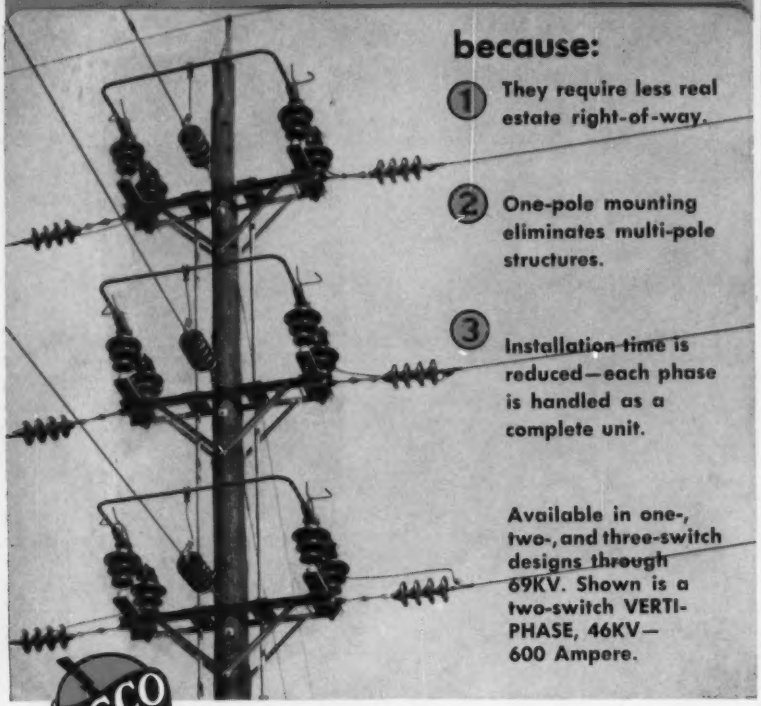
Electrical Products Division

Brookside Park Established 1894 Cleveland 9, Ohio

AGENTS IN PRINCIPAL CITIES

USCO VERTI-PHASE SWITCHES

Accomplish line sectionalizing at the lowest cost for the highest quality


because:
1 They require less real estate right-of-way.
2 One-pole mounting eliminates multi-pole structures.
3 Installation time is reduced—each phase is handled as a complete unit.
Available in one-, two-, and three-switch designs through 69KV. Shown is a two-switch VERTI-PHASE, 46KV—600 Ampere.

The USCO VERTI-PHASE switches are designed to offer savings for line sectionalizing. The single-pole structure required for a VERTI-PHASE three-switch installation offers many cost advantages.

These are not packaged units. VERTI-PHASE switches are designed to meet your specific requirements. Each design is complete with bus tubing, mounting steel, interphase rod, vertical pipe and all other parts necessary for installation.

These units have been proved through years on operating systems. Send us a single-line diagram of your desired switching arrangement and we will quote promptly on the required VERTI-PHASE switches.

All component parts of the Type GS switches and other USCO switches are designed and manufactured in the USCO factory.

USCO Power Equipment Corp.

829 North 36th Way, Birmingham 4, Alabama • Phone LYric 2-7241

Designers and Manufacturers of High Voltage Electrical Equipment for Utilities, Cooperatives and Industry.

varying conditions. The campaign has been supported through newspaper advertising and articles.

The bonus idea is not new to Orcas P&L. It has offered similar plans covering electric water heaters, ranges, washers, and dryers. Cash bonuses of $30 for ranges and $25 for the other appliances helped to sell 230 units among the utility's 1,450 customers in a six-month period early in 1955.

Electric House Heating Slide Film Offered

An 18-min sound slide color film on electric heating has been produced for nation-wide consumer presentation by the Electric House Heating Equipment Section of National Electrical Manufacturers Association.

The 35 mm. slides illustrate all types of resistance electric heating equipment and how much it costs to operate them in representative U. S. areas. It traces the history of man's attempts to create warmth for his home and portrays the advantages of electric heating.

The film package, which includes a 16-in. 33 rpm record, copy of narration and 100 consumer booklets, will be available at a pre-release price of $12.50 on orders received before May 1. The material will be ready for distribution about May 15. The accompanying record is double faced, one side for use with automatic projectors with inaudible signals, the other for manually operated projectors.

To place orders contact Recording Secretary, Electric House Heating Equipment Section, NEMA, 155 E. 44th St, New York 17, N. Y.

S & S SHORTS

At Home with the Range

Electric range sales showed an 88% increase in 1955 over 1954 in Dallas Power & Light Co's areas. In six years, the appliance's saturation has jumped from 2.3% to 15.2%.

Dishwasher, Disposal Sales Zoom

Electric dishwashers in 1955 hit a 37% increase over 1954 sales and waste disposers gained 30% in the same period, Hotpoint Co reports. U. S. consumers spent $90 million for dishwashers, $62 million for disposers last year.

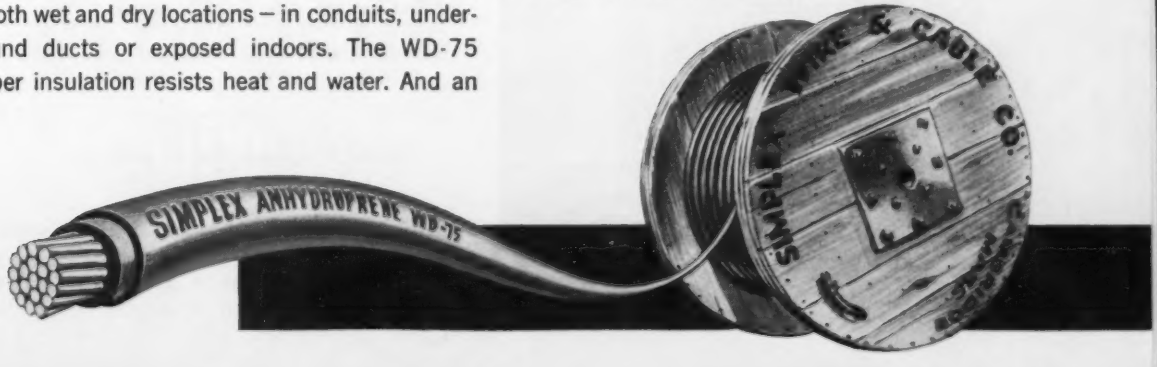
ELECTRICAL CONTRACTOR: Walter J. Barnes Electric Co., New Orleans, La. ENGINEERS: Palmer & Baker, Inc., Mobile, Alabama

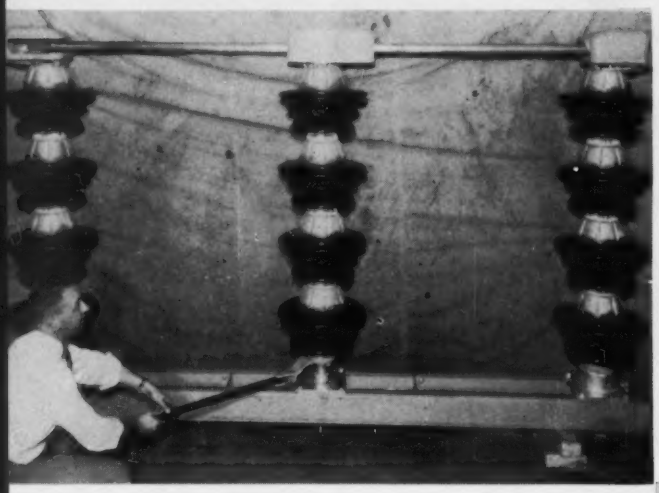
Nearly 50 miles of ANHYDROPRENE WD-75 . . . pushing more power through less space!

ANHYDROPRENE WD-75, Simplex's general-purpose cable, is now being used in two great Southern construction projects: Louisiana's new Belle Chasse and Harvey Tunnels.

Made for 600-volt service, ANHYDROPRENE WD-75 was chosen because it squeezes through more amps in less space. Moreover, it can be used in both wet and dry locations – in conduits, underground ducts or exposed indoors. The WD-75 rubber insulation resists heat and water. And an exclusive Simplex compound makes its neoprene jacket extra tough.

Specify ANHYDROPRENE WD-75 wherever you need maximum power. These wires are available in many colors in most standard sizes. Write for Booklet No. 1018. **SIMPLEX WIRE & CABLE CO.,** 79 Sidney Street, Cambridge 39, Mass.





Double-Break Switch

Line of triple-pole group-operated air-break switches is designed for application as isolating switches. Rated 69, 115 and 161 kv, the new units are of rotating insulator construction, double side-break, with three insulators per pole for horizontal upright mounting and manual or electrical operation.

Features of the line (Type RC) include: Torsion spring for chopping action, low radio influence voltages, anti-friction bearings, and silvered terminal pads.

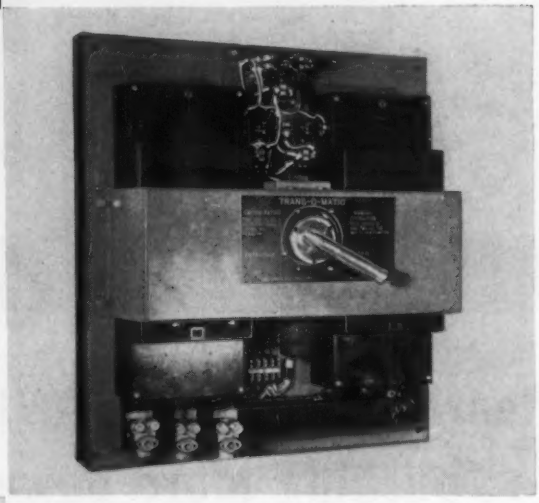
General Electric Co, Schenectady 5, N. Y.

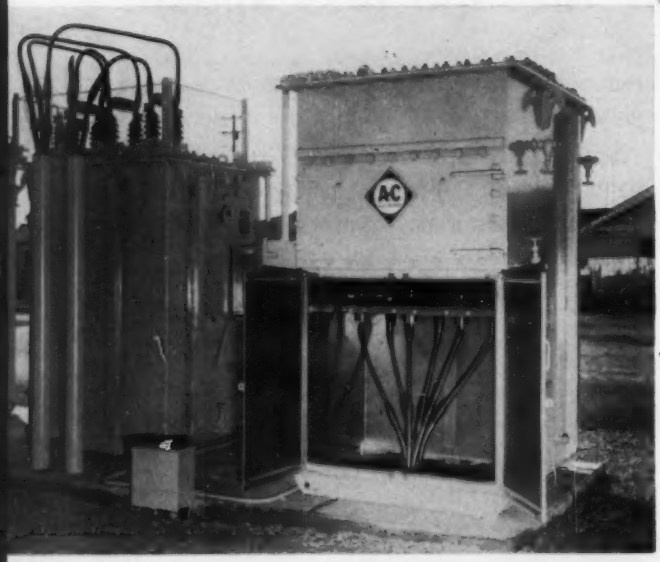
Automatic Transfer Switch

An automatic transfer switch, designed for emergency power service, utilizes two mechanically linked circuit breakers—one from the normal and one from the emergency source. Either will supply the load.

The Trans-O-Matic switch is available in capacities to 600 v, 800 amp, with interrupting capacities to 50,000 amp RMS. Weight of largest unit is 408 lb.

Lake Shore Electric Corp, 205 Willis St, Bedford, Ohio.





Modified Step Regulator

This step regulator has new type connections to underground conductors. The design eliminates top or side junction boxes by enclosing conventional bushings below the load-tap-changing compartment.

The modified regulator, with enclosed compartment open to reveal cable connections for underground leads, is shown alongside a conventional unit.

Allis-Chalmers Mfg Co, Milwaukee 1, Wis.

(*More New Equipment on page* 158)

WHY WIRE AND CABLE JACKETED WITH NEOPRENE GIVE EXTRA-LONG SERVICE

NEOPRENE RESISTS WEATHERING — resists deterioration from exposure to sunlight, weather, and temperature extremes through long years of service.

NEOPRENE RESISTS OIL AND GREASE—and exposure to chemicals and solvents has little effect.

NEOPRENE IS RESILIENT—has excellent resistance to flex cracking, abrasion, chipping, cutting.

NEOPRENE PROTECTS AGAINST ELECTROLYTIC ATTACK—neoprene coverings protect lead sheaths from electrolytic action.

NEOPRENE WON'T SUPPORT COMBUSTION — provides maximum safety in danger areas where flame propagation is a serious hazard.

NEOPRENE RESISTS OZONE and **CORONA CUTTING** — neoprene resists both causes of deterioration equally well.

Neoprene's remarkable *balance of properties* is the big reason why it's the best jacketing material for wire and cable. Rugged neoprene jacketing gives maximum protection in conduits, above ground—even buried direct in earth. Neoprene has had over 20 years of successful field experience in all kinds of rubber products. You can count on long-term dependability when you specify wire and cable jacketed with neoprene. For full details get in touch with your wire and cable supplier.

NEOPRENE

The rubber made by Du Pont since 1932

DU PONT

REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

MAIL THIS COUPON TODAY!

E. I. du Pont de Nemours & Co. (Inc.)
Elastomers Division, EW-4
Wilmington 98, Delaware

FREE! THE NEOPRENE NOTEBOOK. Every issue contains interesting stories about products made with neoprene. Actual case histories give you the facts about neoprene's longer service life. Clip coupon to get on the mailing list.

*Name*_____ *Position*_____

*Firm*_____

*Address*_____

*City*_____ *State*_____

Combustible Gas Indicators

Line of combustible gas indicators consists of four portable models. Each is a 6-lb instrument housed in a 5 x 4 x 6-in. cast aluminum case. Specially designed flame arresters on both sides of the sample flow system permit use of the unit in testing all flammable gases and vapors.

In operation, samples of the atmosphere to be analyzed are drawn through a flexible tube into the unit by squeezing the aspirator bulb. The atmosphere is tested by a balanced Wheatstone Bridge circuit supplied by eight dry-cell flashlight batteries. Further details are in Bulletin No. 0804-2.

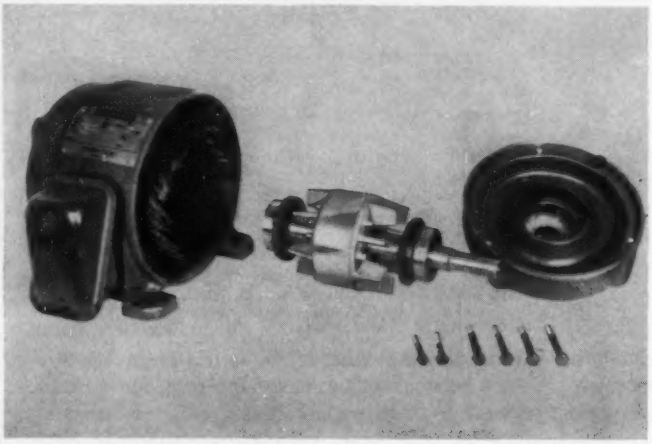
Mine Safety Appliances Co, 201 N. Braddock Ave, Pittsburgh 8, Pa.

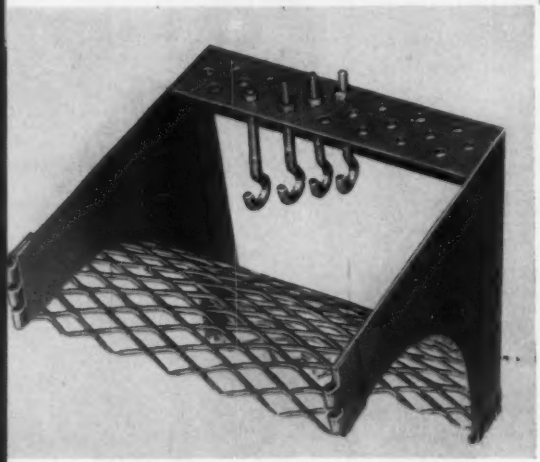
Synduction Motor

A new type of synchronous reluctance motor, known as the Synduction motor, is designed for general industrial use in ¼ to 40-hp ratings (EW, Apr. 9, p 56).

The motor, built on standard induction motor frames and enclosures, uses a simple die-cast rotor. Operation at 300 cps and at speeds above 10,000 rpm are possible.

Allis-Chalmers Mfg Co, Milwaukee 1, Wis.





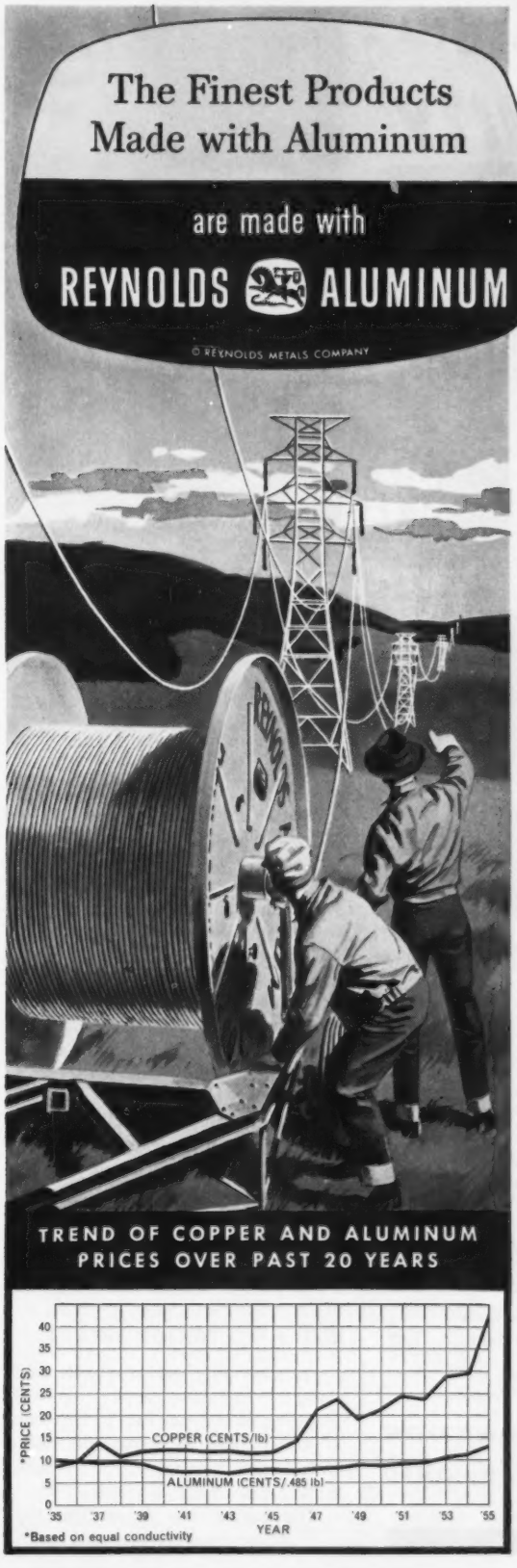
Riser Elbow

Cable-supporting riser elbow is designed to provide for "J" hooks from which cable grips can be hung to support long vertical cable runs. The elbow has been added to other standard fittings in a metal cable trough system.

The elbows are available in widths of 6, 9, 12, 18 and 24 in. The corresponding maximum numbers of "J" hooks for each width are 10, 16, 22, 34 and 46.

T. J. Cope, Inc, Collegeville, Pa.

(*More New Equipment on page* 160)



for example

ACSR

Reynolds ACSR is lighter by 20% than cable made of the next most common material. Thus longer spans are possible, handling and field costs are reduced, jobs are completed faster. As the chart shows, Reynolds ACSR costs less per pound—gives you more conductivity per dollar. And to provide fast shipment of material for emergency requirements Reynolds maintains stocks of most-used sizes.

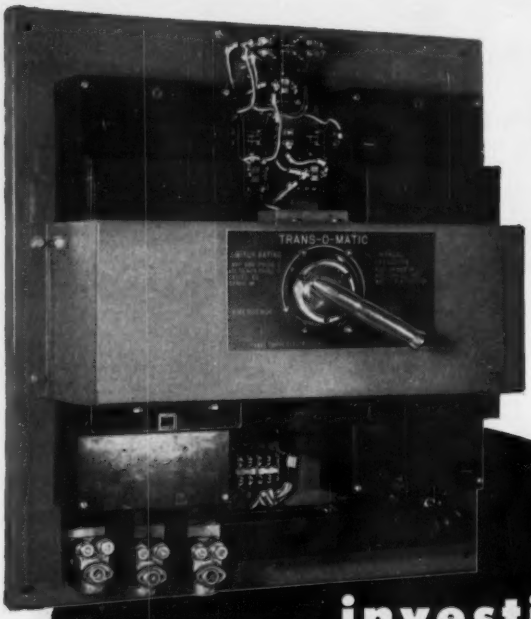
From a cost standpoint alone, you no longer can afford not to consider ACSR. And Reynolds Engineering Service—available to you in your office and in the field—is an important plus in helping you get maximum benefit from the aluminum you use. For full details on ACSR and this service—and on Reynolds Covered Conductor, RABC (Reynolds Aluminum Bus Conductor), RESC (Reynolds Electrical Strip Conductor) and other Reynolds products for the electrical industry—contact your nearest Reynolds Branch Office. Or write *Reynolds Metals Company, P.O. Box 1800-EL, Louisville 1, Kentucky.*

Write to address above for Reynolds prepared "Guide to the Selection of Electric Conductor Accessories" that are available from many manufacturers.

REYNOLDS ALUMINUM

See "Frontier," Reynolds exciting dramatic series—Sunday's, NBC-TV

if YOU'RE responsible for POWER CONTINUITY



TOTAL FAILURE PROTECTION

PARTIAL VOLTAGE FAILURE PROTECTION

POSITIVE NORMAL OR EMERGENCY POSITIONS ONLY

investigate

TRANS-O-MATIC

AUTOMATIC TRANSFER SWITCHES

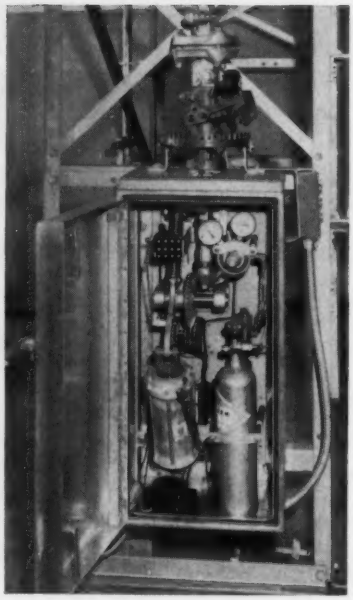
Trans-O-Matic's compact, failure-proof design employs two standard circuit breakers, one from the normal and one from the emergency source, either of which will supply the load. Relay-actuated motor operates circuit breakers for positive mechanical transfer with continuous service in normal or emergency position. Available in capacities to 600 volts, 800 amps, interrupting capacities to 50,000 amps RMS. Prompt delivery in most sizes.

OPTIONAL FEATURES

Adjustable time delay on restoration to 20 minutes • Engine starting contact • Test pushbutton • Pilot lights for switch position • Special enclosures

LAKE SHORE *Electric* **CORPORATION**

BEDFORD, OHIO



Gas-Operated Mechanism

This automatic operating mechanism for air-break switches is adaptable for sectionalizing transmission lines, disconnecting branch lines and transferring loads from one power source to another.

The new mechanism requires no outside source of power. A battery supplies current to actuate solenoids and relays, while a cylinder of compressed nitrogen opens and closes the switches. Manufacturer states that 20 to 30 complete operating cycles can be made before changing the gas cylinder and that the battery will hold 85% of its charge for one year of its ten-year life.

The mechanism has a three-second operating time. For emergency operation it may be fitted with a handle for manual control. The unit is enclosed in a heavy-gauge aluminum case 37 in. high by 17.3 in. wide by 15 in. deep.

Hi-Voltage Equipment Co, 4,000 East 116th St, Cleveland, Ohio.

200-Amp Meter Socket

A heavy-duty socket (Type S) is designed for direct application with watthour meters rated up to 200 amp. It has a 200-amp continuous rating without overheating and is available with full rated circuit closers.

The socket has lay-in-type lugs

(*Continued on page* 162)

...the most efficient mercury lamp ever made

High efficiency in mercury lighting! In the search for better light, Sylvania's scientists have developed new phosphors that enable the Silver-White mercury lamp to produce 10 to 20 per cent *more* light than clear mercury lamps.

The new phosphor in this bulb actually *adds* light, where previous "color improvements" subtracted from the light of the ordinary clear mercury lamp. The silver-white coating on this bulb diffuses and softens the tremendous light output. No other type of mercury lamp gives you so much light for your lighting dollar.

Broad color balance! For the first time in mercury lighting you get radiation across the whole width of the color spectrum.

Lighting costs are reduced! The 400-watt Silver-White mercury lamp gives on the average 7 times the burning hours of life as compared with incandescent of the same wattage.

Sylvania's Silver-White mercury lamps are now available in ratings of: 100-watt, 175-watt and two 400-watt types. They cost no more than other color-corrected mercury lamps of the same wattage. Silver-White gives you brilliant, high efficiency lighting in the factory, service station, parking lot, and in street and highway lighting.

Our commercial engineering department will be glad to help you with your special application or installation problems. For complete technical data write directly to:

SYLVANIA ELECTRIC PRODUCTS INC.
Lighting Division, Salem, Mass.

In Canada: Sylvania Electric (Canada) Ltd.,
University Tower Building,
St. Catherine Street, Montreal, P. Q.

SYLVANIA®

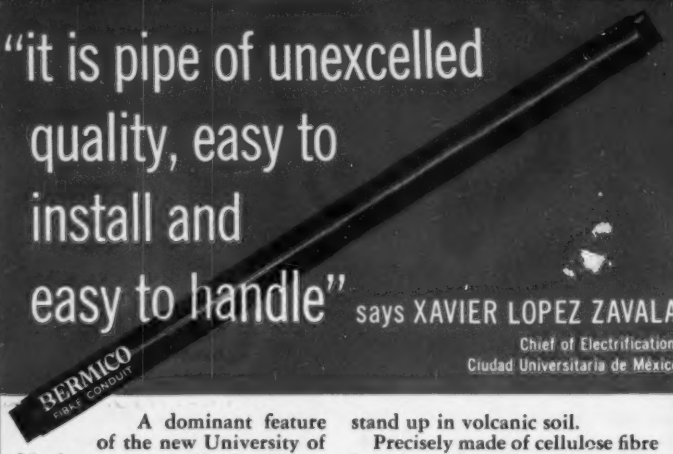
... fastest growing name in sight

LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY

BERMICO® electrical conduit was installed here because.....

"it is pipe of unexcelled quality, easy to install and easy to handle" says XAVIER LOPEZ ZAVALA

Chief of Electrification, Ciudad Universitaria de México



A dominant feature of the new University of Mexico campus, at Mexico City, is the Library pictured above. Because the campus is built on an ancient lava bed, care had to be exercised in selection of underground materials. That Bermico conduit was used to carry the underground electrical wiring is testimony to Bermico's ability to stand up in volcanic soil.

Precisely made of cellulose fibre impregnated with coal tar pitch, Bermico Conduit is both acid- and alkali-resistant, as well as light, tight, strong, and uniform from end to end—yet low in cost.

For lasting protection of underground wiring systems specify Bermico. Immediate shipment of all sizes and fittings.

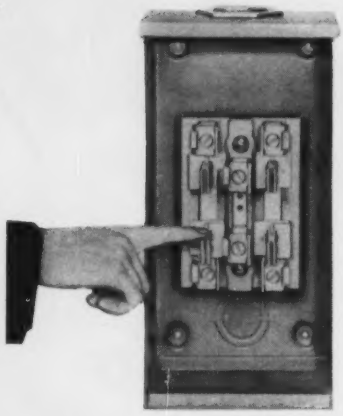
Distributed by WESTINGHOUSE Electric Supply Company

Offices in principal cities

BROWN COMPANY

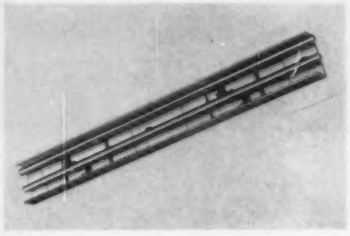
Berlin, New Hampshire

GENERAL SALES OFFICE: 150 CAUSEWAY STREET, BOSTON 14, MASS.



that accept up to 100-Mcm wire. The silver-plated, spring-loaded, current-carrying jaws eliminate need for clamping or bolting the jaws closed. The enclosure is available for surface or semi-flush mounting for plaster-stucco, woodsiding or brick veneer construction.

Square D Co, 6060 Rivard St, Detroit 11, Mich.



Tube Race

This tube race was developed to support a limited number of tubes that often occur in branch runs to and from main runs of a tube supporting system.

The tube race is available in 16-ft sections and in widths of 1, 1½ and 2½ in. It is equipped with tube clips spaced at 2-ft intervals to accommodate ¼ or ⅜-in. tubes. Connections and changes of direction are made by field cutting and welding.

Wider widths of tube race are supplied with a pin-type coupler that permits connections and bends to be made with standard fittings. Tubes are secured in these widths by cushion clamps.

Instrof Corp, Collegeville, Pa.

(*More New Equipment on page* 164)

These Lincoln Semiflush Switchboard Graphics measure substation total load, both KW and KVA. Note individual circuit measurement with Lincoln Triplex Ampere Demand Meters at top of switchboard.

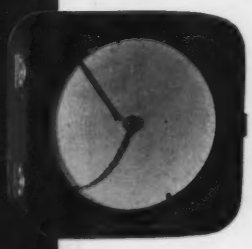
Put Substation Operating Data on Record with LINCOLN GRAPHIC METERS

When knowledge of time and duration of loading conditions is required for system betterment—Lincoln Graphic Meters offer a simplified low-cost means of system measurement. Lincoln Graphics are thermally lagged to integrate minor fluctuations into a clearly defined line, making legible records possible on single charts up to 32 days.

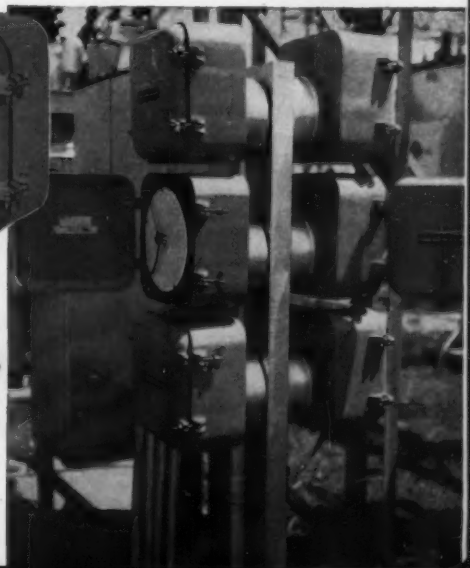
Write today for full information on Lincoln Graphic Meters and Simplified Measurement for System Operation.

SANGAMO ELECTRIC COMPANY • Springfield, Illinois

Three surface-mounted Lincoln Type CCA Graphics measure main station bus current on 8 day charts.



Reactive and Kilowatt Lincoln Demand Graphics in paired sockets correlate feeder KW and RVA in an outdoor substation. These socket type graphics are merely "plugged in". The socket makes the correct connection for each meter.



SM56-2

If you buy distribution transformers

HERE ARE FIVE THINGS YOU SHOULD KNOW

1. Who is RT&E?
A 10 year old manufacturer of distribution transformers, located in Waukesha, Wisconsin. It s personnel have hundreds of years of experience in designing, building and servicing the finest distribution transformers.

2. How big is RT&E?
Not as big as the giants, yet very big in ability, in performance, in engineering and in service. Small enough to value every customer, big enough to service the entire nation.

3. What does RT&E make?
Distribution Transformers in all styles from 3 thru 500 KVA.

4. Are RT&E Transformers different?
Yes, RT&E has pioneered most of the new features of the last 10 years, such as the *Externally Operated Tap Changer, Wick-fed Oil filled Bushing, Balanced Construction Wound-Core* and the *Spiral-Groove Lightning Arrester.*

5. Are RT&E Transformers dependable?
Yes, RT&E is the manufacturer that initiated the FIVE year Guarantee as proof of dependability.

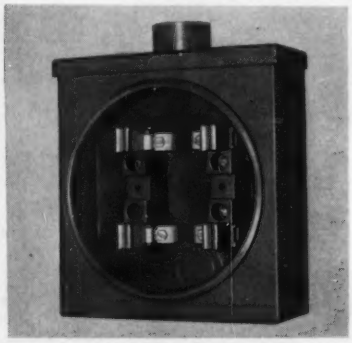
To get the best buy for your company, send for complete details on RT&E's outstanding products.

RT&E CORPORATION
WAUKESHA WISCONSIN

Air Circuit Breakers

Three new adaptations of a line of l-v air circuit breakers are rated at 40 to 600 amp, 25,000-amp interrupting capacity at 600 v ac (LA-25), and 200 to 1,600 amp, 50,000-amp interrupting capacity at 600 v ac (LA-50).

These adaptations are skeleton enclosures (illustrated), pull-out type individual enclosures for wall mounting, and separate breakers for frame or panel mounting. The equipment is available in general purpose, dustproof and weatherproof models.
Allis-Chalmers Mfg Co, 932 S. 70th St, Milwaukee 1, Wis.



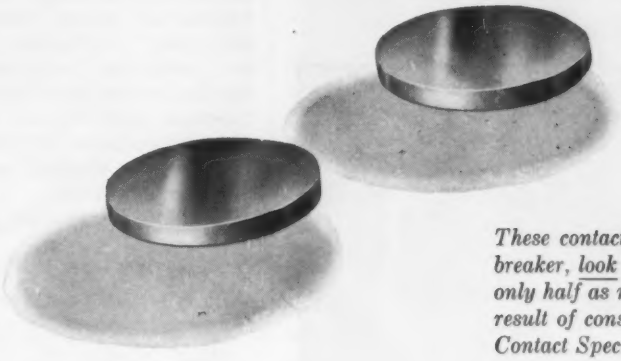
Meter Sockets

Two additions to a line of meter sockets and enclosures are: No. 6881 (illustrated) for mounting the 15-amp extended range socket meter; and No. 68125 (not illustrated) for mounting the 50-amp meter.

No. 6881 has wiring room for maximum 1/0 wire size. Features include: Easy-opening, lay-in type terminals to facilitate wiring; meter spade contact furnished by spring clips; standard

(*Continued on page* 166)

MALLORY



These contacts, for a utility circuit breaker, look alike . . . but one costs only half as much as the other, as a result of consultation with Mallory Contact Specialists.

How Mallory Contact Engineering Balances Performance and Price

Mallory Contact Engineering Offers Five Ways To Improve Economy

1. **The most effective contact material** from the extensive line developed by Mallory. More economical alloys often can satisfy *actual* service conditions.
2. **The most economical contact design . . .** for your purchasing, production and product needs.
3. **The most economical backing material** . . . from a group of Mallory alloys developed for this use.
4. **The most economical backing member design . . .** in relation to contact and product design requirements.
5. **The most economical method of assembly** of contact and backing member.

By coordinating *all* these important elements of contact design, Mallory can help you put into effect a long-range plan for cutting contact cost and assuring peak performance.

CONTACTS can be *too good* for their intended service. Detailed study of a contact application, by Mallory engineers, often uncovers ways to design more closely to actual requirements . . . at substantial savings to the customer.

The contact pictured above is a typical example. Intended for use in a circuit breaker for utility distribution lines, it originally was designed with contacts made of heavy-duty silver ELKONITE®. At first glance, this exceptionally long-wearing, high conductivity metal appeared ideal to meet the customer's original specifications. But further investigation by Mallory contact engineers revealed that while contacts had to operate with absolute dependability, they did not have to function *frequently*.

On the basis of the actual frequency of service expected, Mallory engineers recommended a change to a copper ELKONITE . . . an alloy made of lower priced materials, and more economical to produce. Overall savings to this customer amounted to a 50% cut in contact costs. Moreover, there is no sacrifice in performance for the specific application.

Chances are that consultation by Mallory on your own contact applications can prove the source of interesting savings for you. Mallory engineers are well qualified by years of experience to analyze your requirements, to recommend materials from the extensive line of Mallory alloys, and to assist in overall design of contacts and assemblies. For a discussion, write or call Mallory today.

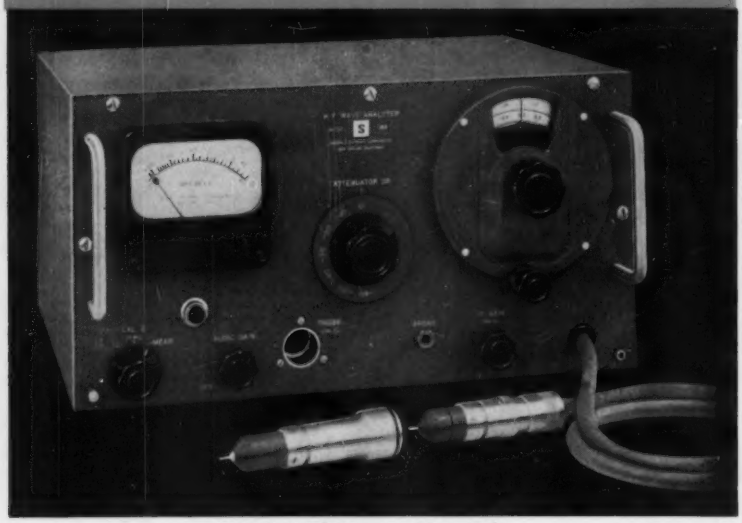
Serving Industry with These Products:

Electromechanical—Resistors • Switches • Tuning Devices • Vibrators
Electrochemical—Capacitors • Rectifiers • Mercury Batteries
Metallurgical—Contacts • Special Metals • Welding Materials

Expect more . . . get more from

P. R. MALLORY & CO. Inc.
MALLORY
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

New hf wave analyzer!



Sierra 158 High Frequency Wave Analyzer

Fast, convenient, 500 KC to 10 MC!

New Sierra 158 Analyzer is a highly selective, double superheterodyne receiver providing wave analysis data direct in dbm referred to 600 ohms impedance. The instrument uses a cathode follower input probe with two detachable capacity dividers for 20 or 40 db attenuation. It also includes a built-in attenuator adjustable in 10 db steps to a maximum of 60 db. These features, in combination with 22 db usable meter readings, provide a measurement range of 122 db, from —80 to +42 dbm. A measurement accuracy of ±2 db is assured for levels above —70 dbm. Spurious components from analyzer circuits are at least 50 db below fundamental. An injection oscillator at 2 mc is provided for rapid voltage calibration. A phone jack is available for aural monitoring. The instrument also includes the Sierra-designed precision spiral-scale frequency dial. *Write for complete data.*

SPECIFICATIONS

Frequency Range: 0.5 to 10 megacycles.

Signal Measurement Range: —80 dbm to +42 dbm, referred to 600 ohms. (77.5 μv to 97.5 v)

Selectivity: 3 db down at 3 kc off; 30 db down at 12 kc off.

Signal Measurement Accuracy: ±2 db above —70 dbm.

Spurious Responses: At least 50 db down.

Input Impedance: Greater than 1 megohm shunted by approximately 8 μμf.

Frequency Calibration Accuracy: Depends on stability and calibration accuracy of the 22.5 - 32 mc variable oscillator, which is maintained within 0.25%. This results in dial accuracy ranging from ±.056 mc to ±.080 mc.

Operating Power Requirements: 105 to 125 volts, 50/60 cps, 95 watts drain.

Cabinet Dimensions: 17 inches wide, 9 1/8 inches high, 13½ inches deep.

Weight: Approximately 40 pounds.

Data Subject to Change Without Notice

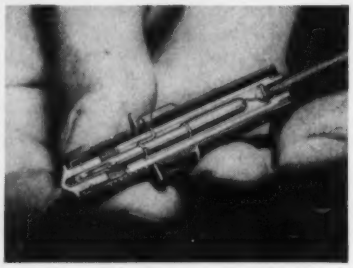
sierra

Sierra Electronic Corporation
San Carlos 2, California, U. S. A.
Sales representatives in major cities
Manufacturers of Carrier Frequency Voltmeters, Wave Analyzers, Line Fault Analyzers, Directional Couplers, Wideband RF Transformers, Custom Radio Transmitters, VHF-UHF Detectors, Variable Impedance Wattmeters, Reflection Coefficient Meters.
3080

knockouts in sides, back and bottom; and hub size available in 1, 1¼ and 1½ in.

No. 68125 is designed for four-terminal meters, and No. 68125-5 for five-terminal meters. Both feature heavy-duty, ringless-type mounting that incorporates heavy bolted castings for positive meter spade contact. Connector terminals have two bolts and accommodate 4/0 conductor. Knockouts are standard, and hub up to 2½ in. is available.

Binkley Mfg Co, Warrenton, Mo.



Overheat Warning Control

A bearing overheat detector thermostat is designed for use on machine bearings and similar equipment. The 1-oz vapor thermal switch (No. 3162) is supplied with vapor mercury contact thermostats that detect a bearing overheat temperature up to 550F and light a warning signal in less than 4 sec.

The unit, enclosed in a steel housing, employs an aluminum temperature-sensing tip that can be compressed 1/32 in. to insure positive contact with the bearing.

Vapor Heating Corp, 80 E. Jackson, Chicago 4, Ill.

MORE NEW PRODUCTS

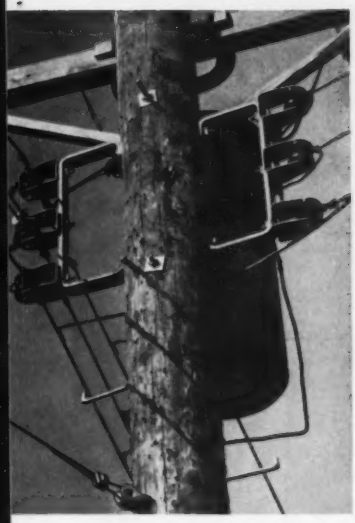
General Dynamics Corp, Electro Dynamic Division, Bayonne, N. J., has a **variable speed drive** known as Selectron. Normal speed range is 22:1 but is available up to 60:1. With tachometer feedback, speed can be controlled to 0.25%.

Motorola, Inc, Communications and Electronics Division, 4501 Augusta Blvd, Chicago 51, Ill., has added a **60-w transmitter-receiver** to its line of fixed FM 2-way radio equipment in

(*Continued on page* 168)

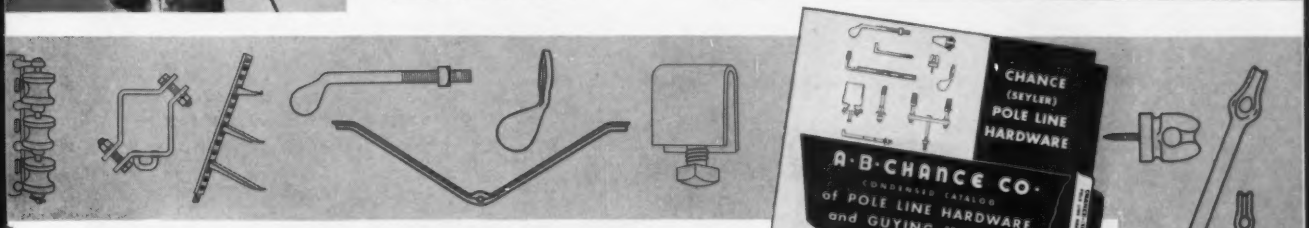
"NOW you can look to CHANCE for pole line hardware too"

"The Seyler Manufacturing Company of Pittsburgh is now the A. B. Chance Company. This means that Chance engineering facilities will be used for the development of new pole line hardware items such as this—



"Secondary Extension Bracket" ... the newest addition to Chance's wide range of pole line hardware. In the typical Union Electric installation shown at left, you can see there's plenty of climbing space on the pole ... a feature which meets the National Safety Code. Notice, too, the adequate clearance between secondary conductors and the outside diameter of the transformer tank."

JACK CURTRIGHT, Sales Manager, Electrical Wholesale Products, introduces the Chance secondary extension bracket. You'll find it is more economical than a standard secondary rack and separate extension brackets. Suggestions for the design of this new unit came from the Union Electric Company of Missouri.



CHANCE (SEYLER) POLE LINE HARDWARE
A·B·CHANCE CO·
CONDENSED CATALOG
of POLE LINE HARDWARE and GUYING MATERIAL
CHANCE ANCHORS and GUYING MATERIAL

Send for your FREE COPY of this condensed Chance Catalog!

Here's a find-it-quick reference for everything you need in pole line hardware and guying material. Actually, it's a combination catalog and file folder. You'll like the way the information is arranged to help you find what you want quickly and easily.

CP56-7

Please send me the Chance *condensed* Pole Line Hardware and Guying Material Catalog.

NAME_____

ADDRESS_____

COMPANY_____

CITY & STATE_____

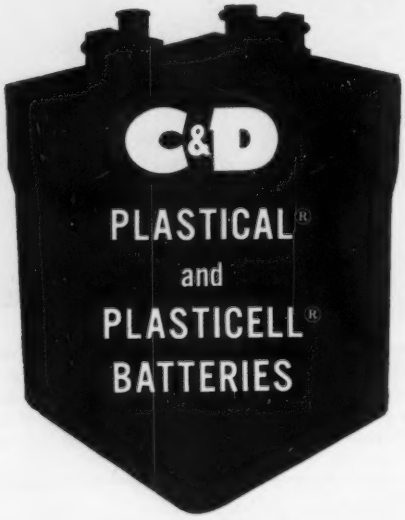
ABC INDUSTRIES

A·B·CHANCE CO·

CENTRALIA, MO., San Francisco, Cal., Pittsburgh, Pa.

Now—"engineered" power

for switchgear-control —emergency lighting —auxiliary power



Compact, modern-design "power plants" engineered for specific applications! C & D PlastiCals and PlastiCells give you completely dependable power—*where power must not fail!*

PlastiCal—with lead-calcium grids for maximum life—is conservatively engineered for at least 25 years in full-float service. PlastiCell—with high-tensile alloy grids—has a projected life of 14 years in float service.

WITH BOTH PLASTICAL AND PLASTICELL YOU GET SUCH ADVANCED C & D DESIGN EXTRAS AS:

1. Extra-long life—exclusive design combines advantages of both suspended and supported plate construction.
2. Triple insulation—thick Fiberglas mat, microporous separators, and perforated Koroseal retainer.
3. Saftee-Vent—outstanding C & D development that prevents accidental battery explosions.
4. Crystal-clear plastic jars—heat-resistant and hermetically sealed.
5. Plastite Post Seals—for easier maintenance, and at the lowest lifetime cost.

Write for C & D Specification Bulletins:
CP-536 Rev. 1 on PlastiCal Batteries
CP-537 Rev. 1 on PlastiCell Batteries

C&D BATTERIES, INC.
of Conshohocken, Pa.
Industrial Batteries since 1906

SALES AND SERVICE OFFICES IN PRINCIPAL CITIES FROM COAST TO COAST

the 25-54 or 144-174 megacycle band. The unit, known as Compa-Station, features a removable control panel with built-in speaker.

Wama Co, Industrial Bldg, Baltimore 2, Md., has an **all-aluminum connector terminal block** rated up to 60 amp at 750 v. Each unit consists of one-piece point and barrier, an end piece, and marking strip.

D. W. Onan & Sons, Inc, Minneapolis, Minn., has a 7.5-kw ac, gasoline-powered **electric generating plant** with a vacuum cooling system and complete accessories.

Homelite, Port Chester, N. Y., has a 5-hp, 19-lb, direct-drive **chain saw** (Model EZ) available with 12, 17, 21, 25 and 30-in. guide bars.

Lincoln Electric Co, Cleveland 17, Ohio, has a **motor line** in standard sizes from 1 to 40 hp. The line features extruded plastic insulation and open-type frame.

Fisher-Pierce Co, Inc, 74 Pearl St, S. Braintree, Boston 85, Mass., has a **load fuse assembly** for mounting inside sockets of photoelectric lighting controls. Installation requires only replacing one meter socket terminal block with the new load fuse terminal block.

Mathias Klein & Sons, 7200 McCormick Road, Chicago 45, Ill., offers **spring pliers** that use a coil spring just below the hinge to keep the pliers open at all times.

General Electric Co, Syracuse, N. Y., has a two-way radio **communication equipment cabinet** for housing transmitter, receiver and power supply chassis at a fixed location. It is 14 in. wide and about same height and depth as a desk.

So-Cal Electro Products, Inc, 4423 W. Jefferson Blvd, Los Angeles 16, Calif., has self-locking **conduit connector hubs** for single or multiple conduit connections to metal service and distribution housings.

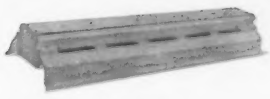
Oil-Rite Corp, 2375 Waldo Blvd, Manitowoc, Wis., has a **pump-operated oil dispenser** that can lubricate a great number of bearings on several machines. Automatic operation and circulation are features.

Wheeler

1881 1956

75 years of service to Business and Industry

Lighting the way to brighter tomorrows



Fluorescent

Street Lighting

Incandescent

Wheeler

REFLECTOR COMPANY
275 Congress Street
Boston 10, Mass.

Distributed Exclusively through Electrical Wholesalers

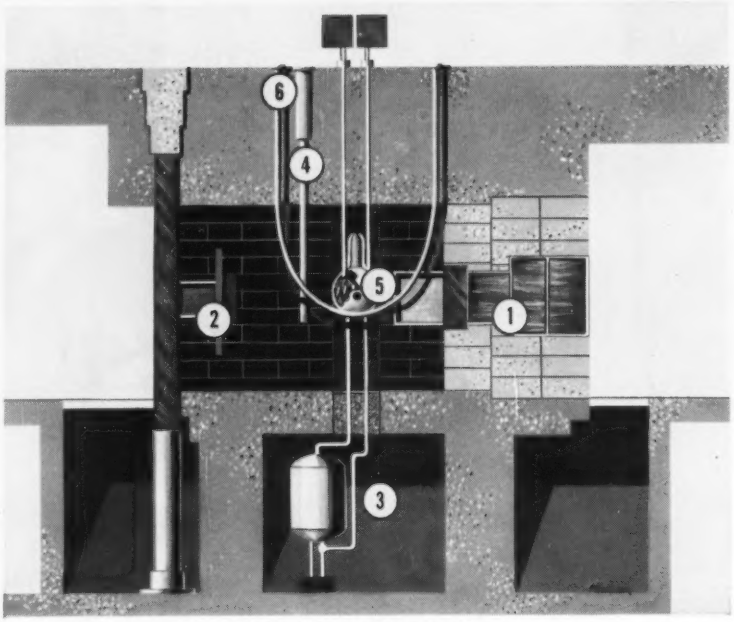
Loaded Carrier almost out of oven after enameling cycle — Red Hot!

(*Advertisement*)

NUCLEAR NEWS FROM ATOMICS INTERNATIONAL

Nuclear Reactor for Cancer and Other Medical Research

This new reactor utilizes the proven homogeneous solution design based on the SUPO unit at Los Alamos—modified and adapted to the special needs of cancer and other medical research and therapy. To be built by ATOMICS INTERNATIONAL for a prominent southern California university Medical Center, the reactor will provide a variety of radiological facilities—primarily high purity neutron and gamma beams with controlled exposure times in each. The thermal neutron flux at the central exposure tube is 1.7×10^{12} n/cm²-sec. at a power of 50 Kw.



Medical Reactor Test Facilities

1. Gamma and Fast Neutron Facility—Gamma intensities of 1.3 reb/min/Kw and fast neutron intensities of 4 reb/min/Kw are available.
2. Thermal Neutron Facility—Provides neutron flux of 3.8×10^7 n/cm²-sec. per kilowatt.
3. Gamma Radiation Area—Activity of the fission gases provides a radiation source in the gas handling equipment room.
4. Multiple Specimen Irradiation Tube—One or more in the reflector. Each accommodates 16 samples.
5. Central Exposure Tube—A 1-inch internal diameter tube through the center of the core permits access to maximum neutron flux.
6. Pneumatic Tubes—Tangential to core. Also (not shown) are Beam Tubes—Radial to core, or through reflector tangential to the core.

Gas handling system assembly for nuclear research reactor. This component, developed by Atomics International, contains facilities for circulating the reactor atmosphere, recombining the radiolytic gases, condensing the water vapor and returning water to the reactor core, in a closed cycle operation. Additionally, the tank at top which contains fission product gases, provides an intense source of neutron-free gamma radiation.

One Configuration of the thermal neutron facility provides a neutron flux of 3.8×10^7 n/cm²-sec/Kw with a gamma ray intensity of only 0.1 reb/min./Kw (reb—roentgen equivalent biological). The fuel is Uranium enriched in the U^{235} isotope in the form of UO_2SO_4 dissolved in light water. This fuel-moderator solution, cooled by chilled recirculated water, is contained in a stainless steel core tank surrounded by a graphite reflector and dense concrete shield. Radiolytic and fission gases produced in operation are handled in a closed-cycle, water recombination and return system, which eliminates any discharge of radioactive core effluents and permits the re-utilization of materials.

Atomics International is a major reactor builder—experienced in the design, construction and operation of nuclear reactors for research and the production of power. If you are interested in any phase of our activities, ATOMICS INTERNATIONAL is staffed and equipped to help you. Please write: Applications Engineering Service, Dept. EW-N1, ATOMICS INTERNATIONAL, P.O. Box 309, Canoga Park, California. Cable address: ATOMICS.

AI

ATOMICS INTERNATIONAL

A DIVISION OF NORTH AMERICAN AVIATION INC.

PIONEERS IN THE CREATIVE USE OF THE ATOM

CATALOGS—BULLETINS

● **AIR CONDITIONING:** Centrifugal refrigerating unit with single-stage compression is described in 8-page Bulletin No. 1426. Construction details are described and illustrated. American Blower Corp, Detroit 32, Mich.

● **RUST PREVENTION:** Uses and applications of a rust-preventive coating are described in 28 page booklet. Form No. 255 includes 102 color chips showing the colors available in various primers, coatings and finishes. Rust-Oleum Corp, 2799 Oakton St, Evanston, Ill.

● **GEARMOTORS:** Line of gearmotors incorporating NEMA motors and completely redesigned gearheads is described in 8-page Bulletin No. E-2408. Reliance Electric & Engineering Co, 1088 Ivanhoe Road, Cleveland 10, Ohio.

● **PIPE FITTINGS:** Corrosion-resistant pipe fittings and flanges in normal-impact grade and high-impact grade, rigid, unplasticized polyvinyl chloride are described in 12-page catalog. It lists operating pressures, temperatures, applications, dimensions and weights. Grinnell Co, Inc, 260 W. Exchange St, Providence 1, R. I.

● **INDUSTRIAL CONTROLS:** Cypak static control systems are discussed in 6-page Bulletin No. B-6584. Illustrated with photographs, drawings and circuit diagrams, the booklet covers: Need for static controls; what they are; how they operate; and where they can be used. Westinghouse Electric Corp, P. O. Box 2099, Pittsburgh 30, Pa.

● **ELECTRIC HEATERS:** Application index, calculating data, specifications, and operating information on a wide line of electric heaters and heating devices are contained in 60-page Bulletin No. GEC-1005G. General Electric Co, Schenectady 5, N. Y.

● **INDUSTRIAL LIGHTING:** Uses of mercury vapor lamps in industrial plants are discussed in 12-page Bulletin No. MV-406. Technical data and operating characteristics are given. Sylvania Electric Products, Inc, 1740 Broadway, New York 19, N. Y.

● **DISTRIBUTION TRANSFORMERS:** Bulletin CS-201 describes construction, product features, and manufacturing processes of a line of distribution transformers, 167 kva and below. The 8-page booklet gives illustrated explanations of materials, design, and processing methods used for each component. Kuhlman Electric Co, Bay City, Mich.

● **INSULATION:** Thermal insulations and refractories for industrial use are described in Bulletin No. IN-171A. The 20-page booklet contains information on composition, physical and thermal properties, and sizes of the products. Johns-Manville, 22 E. 40th St, New York 16, N. Y.

● **INSTRUMENT TRANSFORMERS:** The 1956 Buyer's Guide No. GEC-1028 (80 pages) gives full data on a line of instrument transformers, including latest additions to a group of butyl-molded current transformers. General Electric Co, Schenectady 5, N. Y.

(*More Catalogs on page* 172)

STOP weeds all season

Just one application of "Telvar" controlled weeds around this fence. Note the type of vegetation involved in untreated area in the foreground.

Spray just once with Du Pont TELVAR®

WEED KILLERS

When you use "Telvar" weed killers, vegetation is killed through the roots, and regrowth is prevented because the chemical remains in the soil . . . provides residual action all season long. And low dosages (1 to 1½ lbs. per 1,000 sq. ft.) make it cost little for the results you obtain. Such low rates also mean less handling, less use of storage facilities.

"Telvar" weed killers come as wettable powders, are non-corrosive, non-flammable, non-volatile, low in toxicity to humans and livestock.

Include "Telvar" weed killers in your weed-control program this year. Prove to yourself how these products of Du Pont research can help cut your maintenance cost to new low levels.

Where brush is a problem, Du Pont Ammate® X weed and brush killer is the product you need. It kills more kinds of brush with unusual safety. With ordinary precautions, "Ammate" X may be used close to such crops as cotton, tomatoes, soybeans and peanuts.

• • •

FREE ILLUSTRATED BOOKLETS describe how to control weeds and brush with Du Pont chemicals. Write to Du Pont, Grasselli Chemicals Dept., Rm. D-4032, Wilmington, Del. In Canada, Du Pont Company of Canada Limited, 80 Richmond Street West, Toronto, Canada.

DU PONT
REG. U. S. PAT. OFF.

On all chemicals, follow label instructions and warnings carefully.

WEED and BRUSH KILLERS

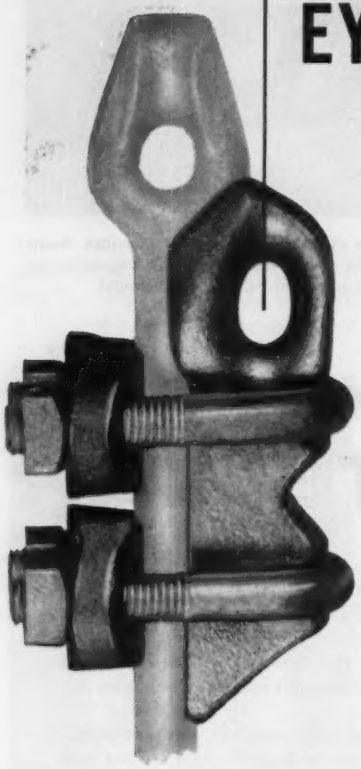
BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

MIF

malleable iron

HIGH CORROSION RESISTANT

AUXILIARY EYE



Secured directly to a thimble or oval eye anchor rod it provides an additional eye for another guy, either permanent or temporary, or serves as a temporary attaching point for blocks or come along.

Where the strength of the existing anchor rod and capacity of anchor are adequate, using the MIF Auxiliary Eye eliminates costly digging and saves valuable time and material.

MIF Auxiliary Eyes come in various sizes to accommodate bolt and rod diameters of from ⅝" to 1".

For further information Write for Bulletin PH 3.

MALLEABLE IRON FITTINGS COMPANY

POLE HARDWARE DIVISION

Branford, Connecticut

MIF

Canadian Mfr. & Dist.: LINE & CABLE ACCESSORIES, Ltd. TORONTO

Representatives: William J. Cottrell Co., Portland, Ore. • James H. Drew Corp., Indianapolis, Ind. • Industrial Engr. & Equip. Corp., Los Angeles, Cal. • JSG Electric Co., Chicago, Ill. • Lee-Smith Co., Miami, Fla. • B. H. McCoin, Knoxville, Tenn. • William J. O'Brien, Memphis, Tenn. • Robert P. Smith & Co., Jacksonville, Fla. • E. A. Thornwell, Inc., Atlanta, Ga. • J. P. Voight, Summerville, S. C. • Waltham, DeWitt & Krusi, San Francisco, Cal. • L. G. Wendegatz, Kansas City, Mo. • Williamson Sales Co., Shreveport and New Orleans, La.; Dallas, Houston, Tex.; Pine Bluff, Ark. • O. C. Witte Co., Detroit, Mich.

Catalogs-Bulletins

(*Continued from page* 171)

• **CAPACITOR EQUIPMENTS:** Enclosed capacitor equipments for h-v installations are described in 12-page Bulletin No. GEA-2860D. The booklet covers application of ready-assembled equipments, 600 to 5,400 kvar, 2.4 kv and above, to reduce voltage drop and cut power losses. General Electric Co, Schenectady 5, N. Y.

• **PIPE PUSHER:** Portable hydraulic conduit and pipe pusher for one-man operation is described in 4-page bulletin. Model A-40 handles ½ to 3-in. pipe, and Model A-60 handles 1 to 4-in. pipe. Both units have choice of electric, gasoline, or truck power unit. Mercury Hydraulics, Inc, 2440 Blake St, Denver 5, Colo.

• **SIGNALS:** Use of visual and audible signals in all types of plants is subject of Bulletin 100. The 8-page booklet uses charts and diagrams to cover paging systems, danger signals, general alarm systems. Federal Sign & Signal Corp, Signal Division, Dept PR, 8700 S. State St, Chicago 19, Ill.

• **INSIDE TELEPHONES:** Circular 1865 (12 pages) tells how ten different organizations saved money with P-A-X, a privately owned, rent-free dial telephone system used for inside calls only. Automatic Electric Sales Corp, 1033 W. Van Buren St, Chicago 7, Ill.

• **DISTRIBUTION REGULATORS:** Bulletin No. 21B7977A describes and portrays features of construction, installation, operation and maintenance of a line of ⅝% step voltage regulators. The 16-page booklet includes specifications and lists standard accessories. Allis-Chalmers Mfg Co, 932 S. 70th St, Milwaukee, Wis.

• **AUTOMATIC RECLOSER:** Type HR automatic recloser with hydraulic timing mechanism is described in 8-page Bulletin No. GEC-1374A. It includes product features, application information, ratings, dimensions, and price data on the unit which is now available for 14.4 kv at 50 amp. General Electric Co, Schenectady 5, N. Y.

• **GRIP SELECTOR:** A grip selector card shows the proper Klein grip to use on popular sizes and types of aluminum, steel, and copper, solid and strand, weatherproof and bare wire. Selector shows grip number, safe load, and weight of the particular grip recommended for each type of wire. Mathias Klein & Sons, 7200 McCormick Road, Skokie, Chicago 45, Ill.

• **ELECTRIC PLANTS:** Bulletin No. 955 covers electric plants from 5 through 250-kw capacity for automatic or manual starting. The 8-page booklet discusses selection factors, typical specification, installation, and automatic starting controls. International Fermont Machinery Co, Inc, Ramapo, N. Y.

• **UNDERGROUND DUCT:** Bulletin 56-A describes Oct-O-Duct, an underground duct made of a mixture of finely ground soapstone, cement and other inert materials, then extruded under high pressure and steam cured. Schematics, specifications, and descriptions cover ducts, bends, adapters, couplings, junctions, spacers, and other items. Soapstone Duct Co, 3985 Beach St, Oakland 8, Calif.

● **RUBBER GLOVES:** An 18 by 22-in. poster card shows how to care for rubber protective gloves and sleeves used by linemen who handle hot wires. Charleston Rubber Co, 220 Stark Industrial Park, Charleston, S. C.

● **LINE BODY:** Two-man line body (Model 5000 WDF) is described in 4-page Bulletin No. 916 which covers standard and optional body equipment and two types of kits. The body is equipped with pole-hole digger, pole derrick, and power reel. York-Hoover Corp, Body Division, York, Pa.

● **DRAFT FAN:** Redesigned airfoil-type draft fan for power plant operations is described in an 8-page bulletin. Photographs, specific speed curves, and fan selection charts are included. Green Fuel Economizer Co, Inc, Beacon, N. Y.

● **TRANSFER SWITCHES:** Line of control and transfer switches for l-v applications up to 600 v ac or dc is covered in Bulletin No. GEA-4746B. The 28-page booklet includes photos, drawings, cutaways, application data, and contact diagrams. Switches with water-tight and explosion-proof housings are described. General Electric Co, Schenectady 5, N. Y.

● **DISTRIBUTION TRANSFORMERS:** Bulletin No. 61B8355 (16 pages) describes and pictures the inspection methods and acceptance tests used in production of a line of distribution transformers. Allis-Chalmers Mfg Co, 932 S. 70th St, Milwaukee, Wis.

● **LINE WIRE COVERING:** Performance of Bakelite polyethylene compound DE-6401 Black-99 as line wire covering is subject of 21-page Kabelitems No. 88. Bakelite Co, 30 E. 42 St, New York 17, N. Y.

● **OUTDOOR LIGHTING:** Fluorescent luminaire for outdoor applications is subject of a 12-page brochure. It includes descriptions, photographs, and illustrations of the Luxaire luminaire, davit-type and conventional standards, and special units. Pfaff & Kendall, 84 Foundry St, Newark 5, N. J.

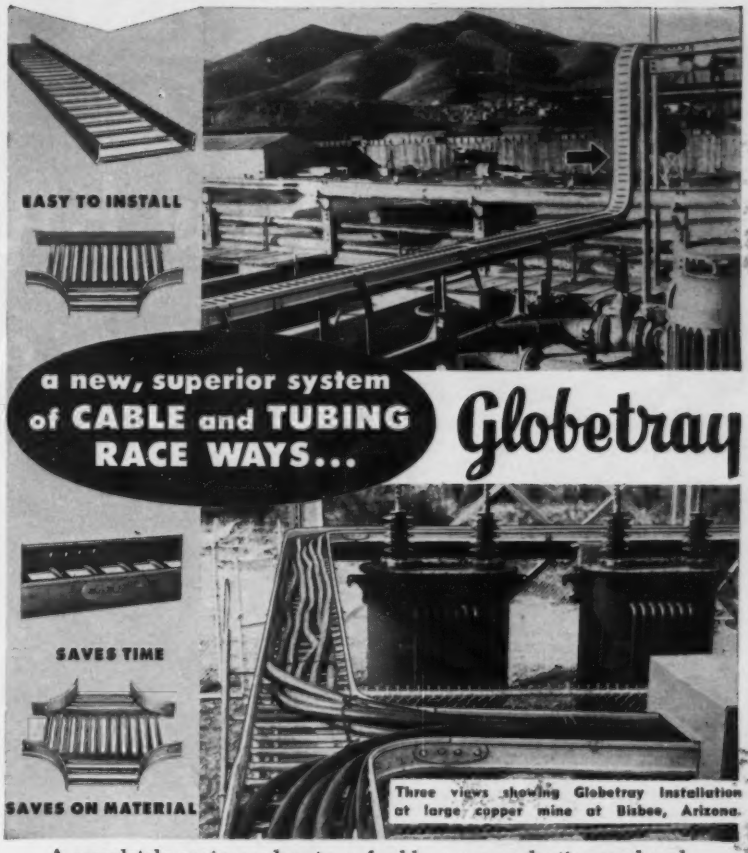
● **AIR SWITCHES:** Application, description and dimensions of a line of horizontal-opening air switches are described in a 20-page bulletin. The switches range from 7.5 to 161 kv in all momentary ratings. I-T-E Circuit Breaker Co, R&IE Equipment Division, Greensburg, Pa.

● **METER SOCKETS:** Bulletin No. GEA-5878B, 20 pages, gives application and selection data on a meter socket line, including round and square die-cast sockets, box-type for standard polyphase, and high capacity single and polyphase meters. General Electric Co, Schenectady 5, N. Y.

● **AXIAL FANS:** Bulletin No. B-1013, 36 pages, describes Series 203 axial fans for ventilation, process air supply and process air recirculation applications. American Blower Corp, Detroit 32, Mich.

● **DISCONNECTING SWITCHES:** Design, construction and operation of a line of single-pole outdoor, hook-operated disconnecting switches (Type B-2K) are given in 6-page Bulletin No. 5601. Tables give ratings and dimensions. Delta-Star Electric Division, 2437 Fulton St, Chicago 12, Ill.

(*More Catalogs on page* 176)


EASY TO INSTALL
a new, superior system of CABLE and TUBING RACE WAYS...
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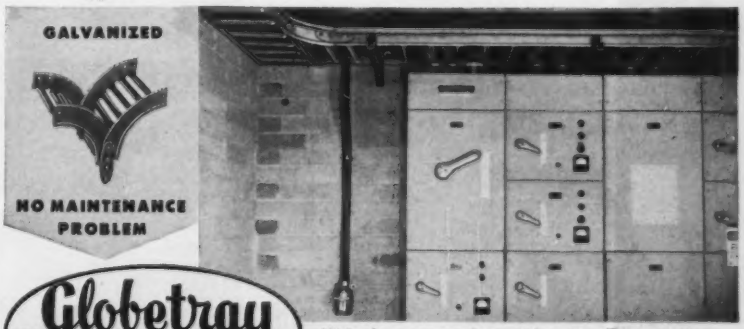
SAVES TIME
SAVES ON MATERIAL
Three views showing Globetray installation at large copper mine at Bisbee, Arizona.

A completely engineered system of cable ways, production produced and die formed for uniformity with up to twice the strength of ordinary trays, by actual laboratory tests. The universal splice plate joins all parts through the side channels only. All curved fittings are joined at the end of the radius (no tangent material is required) permitting continuous curves. This feature provides greater flexibility of application in tight places and creates an endless variety of combinations for a simple solution to any design problem of change of direction or elevation with a complete set of standard fittings.

Comes in 6", 12", 18" and 24" widths, in standard 12' lengths to further speed up installation time. Cable way can be cut to length at any point – insides and bottom always smooth – all sections punched for easy installation – perfect fit at all times. Neat, clean and uniform in appearance.



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THE GLOBE COMPANY

Write for new complete catalog. Distributors in all principal cities. Contact the Grip-Strut distributor under "Conduits" in the classifed telephone directory.

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When the New York Thruway planners specified HAPCO Aluminum Alloy Lighting Standards for the Tappan Zee Bridge, they specified the end of pole painting maintenance. For this most concentrated over-the-water lighting installation in the world posed a major maintenance problem due to its exposure to great amounts of moisture.

Solving the problem with 220 HAPCO Tapered Aluminum Poles and 35 special HAPCO Lighting Brackets for mounting on the middle span was a no-maintenance investment. That's because HAPCO Aluminum Poles and Brackets are corrosion resistant. They require no initial or maintenance painting. Maximum structural strength is assured because HAPCO Poles are spun from Aluminum alloy and heat-treated. Their silver grey beauty blends with the most modern surroundings, provides high visibility for maximum safety.

What's more, HAPCO Standards are designed to fit your individual requirements. Your Hubbard representative will be glad to assist you in specifying the HAPCO Pole that exactly fits your needs. And they're available from more than 300 leading electrical distributors throughout the United States.

Free HAPCO Catalog

If you'd like more details on design features and specifications of the complete Hapco line, write for catalog HAL 754. It contains valuable information to help you plan the most efficient, most beautiful highway and street lighting, as well as any other outdoor lighting requirement. (Hubbard Aluminum Products Company, 6301 Butler Street, Pittsburgh 1, Pa.)

HUBBARD

ALUMINUM PRODUCTS COMPANY
Division of Hubbard & Company
Pittsburgh 1, Pa.

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You'll find that an ever-increasing number of public utilities, transit companies and similar organizations are depending upon CF&I for their guy, messenger and weldless overhead ground wire requirements.

That's because CF&I offers a complete line of top-quality galvanized 7-wire* twisted steel strand that's carefully quality-controlled by CF&I throughout *every* stage of production. This quality control is important to you! It's your assurance that CF&I Strand is always made from steel that has exactly the right chemical and physical properties to fill your needs . . . and that this steel is carefully drawn, galvanized and stranded into a product that'll give years of satisfying service.

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CF&I Strand For Public Utility And Similar Applications Fully Meets Or Exceeds The Latest Applicable ASTM Specification (A-122 For Guy And Messenger Wire; A-363 For *Weldless* Overhead Ground Wire).

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Catalogs-Bulletins

(*Continued from page* 173)

• **DISTRIBUTION EQUIPMENT:** Bulletin No. GEC-1032A is a 1956-57 general catalog of l-v electrical distribution equipment and components. It contains 160 pages of photos, descriptions, ratings, and application information. General Electric Co, 87 Whiting St, Plainville, Conn.

• **PROTECTIVE RELAYS:** Maintenance and testing of protective relays is subject of 4-page Data Sheet No. 156UB. Test equipment and auxiliary instruments are described. Multi-Amp Corp, 10 Third St, Newark, N. J.

• **FLUORESCENT BALLASTS:** Sound rating system, quality control, life expectancy, and design features of a line of fluorescent ballasts are described in 20-page Bulletin No. GEA-6249. General Electric Co, Schenectady 5, N. Y.

TECHNICAL LITERATURE

SUPERCRITICAL PRESSURE—Economic advantages and disadvantages of the supercritical-pressure steam power plant as compared with a conventional-pressure plant are discussed in Bulletin No. 03R8432. The 16-page paper presents a design for a turbine operating at 3,500 psig, 1,150F inlet conditions. Design and operational features of other components are discussed, and an economic evaluation of the estimated station incremental costs of heat-rate gains is given. No charge. Allis-Chalmers Mfg Co, 932 S. 70th St, Milwaukee, Wis.

ASTM STANDARDS—1955 edition has over 11,000 pages and includes more than 2,150 standard specifications, tests, and definitions for materials. The book is issued in seven parts: Part 1—Ferrous Metals, 315 standards, 1,834 pages, $13.50; Part 2—Non-Ferrous Metals, 270 standards, 1,516 pages, $11.00; Part 3—Cement, Concrete, Ceramics, Thermal Insulation, Road Materials, Waterproofing and Soils, 477 standards, 2,062 pages, $13.50; Part 4—Paint, Naval Stores, Wood Cellulose, Wax Polishes, Sandwich Building Constructions, 323 standards, 1,416 pages, $11.00; Part 5—Fuels, Petroleum, Aromatic Hydrocarbons, Engine Antifreezes, 242 standards, 1,496 pages, $11.00; Part 6—Electrical Insulation, Electronic Materials, Plastics, Rubber, 300 standards, 1,776 pages, $13.00; and Part 7—Textiles, Soap, Water, Paper, Adhesives, Shipping Containers, 354 standards, 1,692 pages, $11.00. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

SUN BATTERIES—"The Use of Selenium Photocells and Sun Batteries" describes applications and devices in which sun batteries and other photocell products are used. The 58-page book contains illustrations, charts and diagrams. Price $1.50. International Rectifier Corp, El Segundo, Calif.

CRANES—Crane Classification Card describes and illustrates the five crane service classes established by National Electrical Manufacturers Association. Ederer Engineering Co, 2931 First Ave South, Seattle 4, Wash.

DEPENDABILITY

...EVEN WITHOUT STANDBY... WITH RCA MICROWAVE

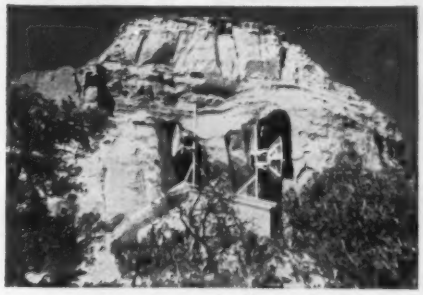
IN VITAL 2-SYSTEM OPERATION AT EL PASO NATURAL GAS CO.

The dependability and flexibility of RCA CW-20 Microwave equipment have been demonstrated at El Paso Natural Gas Co. An original 290-mile pipeline installation in Texas, in 1953, has more recently been augmented by a newer 475-mile system in western Texas and New Mexico . . . achieved with a minimum of expense.

According to the Superintendent of Communications of El Paso Natural Gas Co., outage time has never been more than 1%—without standby and wholly without overtime maintenance. In addition, it has been possible to rearrange the systems to fit new requirements as they arise.

The original installation with short-haul leg circuits was used for voice channels and telemetering. Because of its reliability, additional channels were added, and RCA Equipment was chosen for the second installation.

Routes of El Paso Natural Gas Co.'s pipeline microwave systems in mountainous regions of Texas and New Mexico, and (below) microwave antennas on mountain.



RCA MICROWAVE assures the most advanced engineering features. Provision for the addition of future channels makes it the least expensive form of communication per channel mile. Equipment utilizes easy-to-service familiar circuits and conventional tubes. Single side-band suppressed carrier frequency division multiplexing is used exclusively to meet high standards of dependability. Frequency is controlled only from the terminals through the entire system. Furthermore, RCA provides the nation-wide services of the RCA Service Company to keep entire system operating at its peak.

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close fits for fittings
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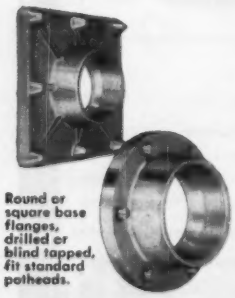

● Narrow base flange terminators for limited mounting spaces are one of many standard types of PLM armored cable fittings for special needs. Many other "specials"— in dimensions, drilling or other details — can be supplied on short notice.

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BOOKS

Books Received Since February 9

Rural Electrification. By J. P. Schaenzer. Published by Bruce Publishing Co., Milwaukee 1, Wisconsin. 378 pages, illustrated. Price $3.75.

Electricity Undertakings of the World. By Electrical Journal Red Book 1955-56. Published by Benn Brothers Ltd., Bouverie House, 154 Fleet Street, London EC 4, England. 626 pages, illustrated.

Electrical Estimating. By Ray Ashley. Published by McGraw-Hill Book Co. 330 W. 42nd St., New York 36, N. Y. 363 pages, illustrated. Price $8.00.

Synchros, Self-Synchronous Devices and Electrical Servo-Mechanisms. By Leonard R. Crow Published by Scientific Book Publishing Co., Vincennes, Indiana. 222 pages, illustrated. Price $4.20.

Electronic Data Processing for Business and Industry. By Richard G. Canning. Published by John Wiley & Sons, 440 Fourth Ave, New York 16, N. Y. 332 pages, illustrated. Price $7.00

Electric Generation—Hydro, Diesel, and Gas-Turbine Stations. By Bernhardt G. A. Skrotzki. Published by McGraw-Hill Book Co, 330 West 42nd St, N. Y. 36, N. Y. 458 pages, illustrated. Price $8.50.

Economic Geography of Industrial Materials. By Albert S. Carlton. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. 494 pages, illustrated. Price $12.50.

Electrical Who's Who—1956-57. Compiled by Electrical Review. Published by Electrical Review Publications, Ltd, Distributed by Iliffe & Sons, Ltd, Dorset House, Stamford St, London, SE1. 458 pages. Price 21s net.

Modern Concepts of Cooling

The Cooling of Electric Machines and Cables. By Theodore de Koning. Published by Zuid Nederlandsche Drukkery, s'Hertogenbosch, Holland. 233 pages, illustrated. Price to electrical manufacturers $15.00, to others $5.00.

This unusual book had its origin in five engineering papers, several of which were in the forefront of design advances which have opened new horizons in recent years. These papers have been extended and supplemented by three heretofore unpublished. All eight reflect the conviction that cooling is the key to continued progress and that engineers with thorough knowledge of electrical and magnetic phenomena find trouble in understanding heat flow.

Scope of the book is best revealed by the titles of its 8 papers. They are:

1. Vaporization cooling of large electric machines.
2. Light weight turbogenerator rotors.
3. Stator windings and generator leads.
4. Monocast electric rotors and stators.
5. Cooling large commutator machines.
6. Skin-cooled, electric, ship-propulsion motors.
7. Steel-plant, electric, rolling mill drives.

8. Low-specific-gravity transmission cables.

All are easily read and uncomplicated by mathematics.

This book would have its greatest interest to recent engineering graduates moving into design of electrical machines and to the engineers who specify and operate them.

Pipes for Power Plants

Design of Piping Systems—2nd Edition. By engineers of M. W. Kellogg Co. Published by John Wiley & Sons, Inc. 440 Fourth Ave, New York 16, N. Y. 365 pages, illustrated. Price $15.00

Entire subject of structural design of piping is covered in detail with emphasis on flexibility analysis of critical systems. Second edition includes a greatly augmented treatment of local flexibility and stress intensification, and a chapter on simplified methods of flexibility analysis.

Text begins with an introductory chapter on the physics of materials. Then two chapters are devoted to design assumptions and limits, stress evaluation, and effect of local components (bends, bolted flanges etc.). After this, three analysis methods are discussed: simple approach, general detailed method and model testing. Closing chapters cover expansion joints, pipe support systems, and vibration. Appendixes provide a very complete biblography on the subject, development of mathematical formulae used, and charts and tables used in design work. And each chapter contains a good list of references.

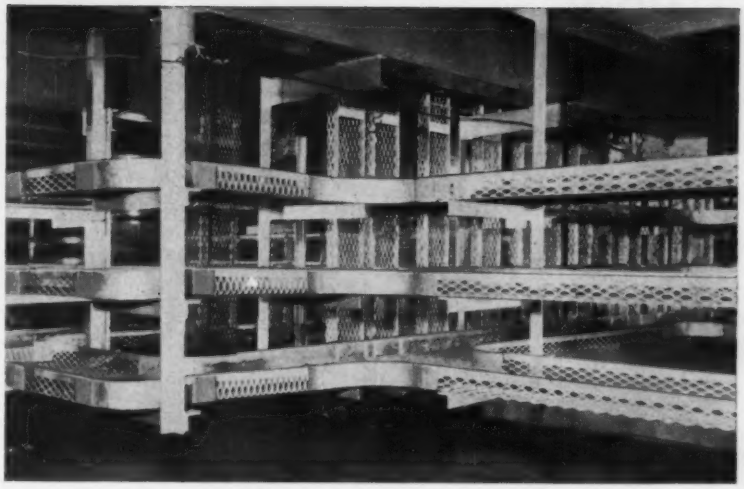
This is an excellent book on this specialized subject and should be a "must" for all power plant pipe system designers.

Leisure Reading in Nucleonics

Atomic Power. By the Editors of Scientific American. Published by Simon and Schuster, Inc, Rockefeller Center, 630 Fifth Avenue, New York 20, New York. 180 pages. Price $1.00.

Chapters of this book were first published as articles in Scientific American. Title is misleading because subjects other than power are discussed. Individual articles are grouped under six main categories: power reactors, resources, fuel and fission products, economics and politics, radiobiology, and thermonuclear reactions. All authors are recognized authorities in their fields.

Book is written for the layman yet its level of presentation is such that it will command attention of the engineer who does not have formal training in nucleonics. One of the best articles in the collection is an explanation of the lethal effects of radiation. A very good round up of foreign achievements in this field is contained in an article about the Geneva Conference.



Cope Cable Trough at Kansas City Power & Light Company's Hawthorn Station.

Kansas City Power & Light Adopts Cope Cable Trough

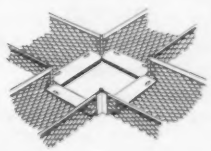
Kansas City Power & Light Company engineers installed versatile Cope Expanded Metal Cable Trough for cable supports in the modern Hawthorn Station. Forward looking engineers in utilities and industry everywhere are building modern distribution systems with Cope Cable Trough.

When you specify an Expanded Metal Cable Trough System you **save materials.** Cope Trough and Rakit Supports provide only the material you need and give you the **lowest installed cost of any cable supporting system.**

Engineers everywhere are specifying Cope Expanded Metal Cable Trough because it:

Saves Materials • Saves Space • Simplifies Maintenance and Inspection
Permits Higher Cable Current Ratings Improves Flexibility

New Cope 70,000 Series features exclusive Pin-Type Coupler that greatly reduces installation time.



C-605

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ROD GRAPPLES

CABLE REEL JACKS

PNEUMATIC FISHLINE

→NOW...
test any relay
right on the line
with a portable
MULTI-AMP®

Here's a versatile instrument that takes all the guesswork out of testing your protective and overload relays, current transformers, thermal breakers and related devices. It saves time, too. Only four connections are required with this rugged self-contained Multi-Amp Model 1004, complete with built-in multi-range A.C. meter and timer. Weighs only 35 pounds, including case. It tells you how each piece of protective equipment measures up to the job it is supposed to do!

For testing and calibrating voltage-operated devices, Model 1004-V has all the advantages of Model 1004 plus adjustable voltage output.

A simple maintenance check with the Series 1004 reveals faulty devices immediately . . . prevents equipment damages . . . avoids confusion caused by breakdown emergencies . . . saves "downtime" losses.

Multi-Amp instruments range from compact 0.4 KVA portable models to custom-designed 500 KVA units for testing, calibrating and coordinating all current actuated protective devices. Instruments for special requirements can be developed by our engineering staff.

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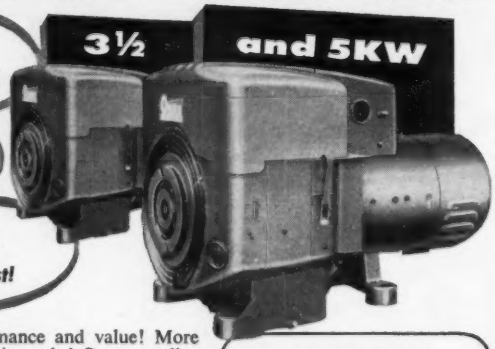
Write today for Data Sheet 1156 on the 1004 series.

TAKE THE "GUESS" OUT OF ELECTRICAL PROTECTION

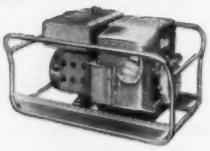
New ONAN CCK Electric Plants

MORE OUTPUT *per pound of weight!*
MORE OUTPUT *per gallon of fuel!*
MORE OUTPUT *per dollar cost!*



Way ahead in performance and value! More powerful, two-cylinder, air cooled Onan gasoline engines of 4-cycle, horizontally-opposed design give smooth, quieter, effortless performance. Short stroke and moderate speed cut engine wear, give longer life. Quality features include rotating Stellite-faced exhaust valves, solid Stellite valve seat inserts, full pressure lubrication. Onan's exclusive Vacu-Flo cooling system available for difficult or "buried" installations.

Completely Onan-built, with Onan gasoline engines direct-connected to Onan all-climate generators in compact, rugged units. Available in stationary, portable and standby models with a wide range of accessories.



PORTABLE MODELS
Available with carrying frames or 2-wheel dollies. Easily portable. Other Onan portable models: 500 to 10,000 watts.

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2942 University Avenue Southeast, Minneapolis 14, Minnesota

BOOKS

(*Continued from page* 179)

Chapter on thermonuclear reactions is actually two articles on the hydrogen bomb—its principle, its effects, and its political and moral consequences. Possibility of peacetime use of the fusion process is not discussed.

This is definitely not a deep or detailed book but for the engineer who likes to stick to his field even in leisure reading.

Nuclear Material Primer

Materials for Nuclear Power Reactors. By H. H. Hausner and S. B. Roboff. Published by Reinhold Publishing Corp, 430 Park Avenue, New York 22, New York. 224 pages, illustrated. Price $3.50.

This book treats the subject of reactor technology from the viewpoint of material requirements. After introducing the reader to reactors in general, the authors present chapters on the various reactor components—fuels, moderators, coolants, etc. Each chapter first describes the needs and functions of the component, and then discusses the material used for this part of the reactor system. Concluding chapters have information on materials in general and methods and equipment used for handling radioactive substances.

The book should prove an excellent primer for the layman or student with no previous nuclear background. But the elementary approach, paucity of illustrations, and meagre references limit its appeal to engineers in the atomic field.

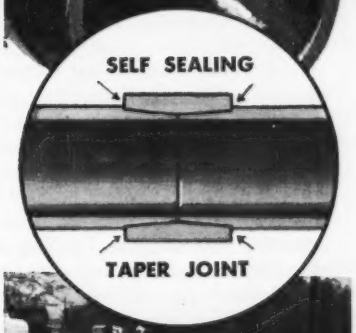
How to Plan Construction

Construction Planning, Equipment, and Methods. By R. L. Peurifoy. Published by McGraw-Hill Book Co, Inc, 330 West 42nd St, New York, N. Y. 534 pages, illustrated. Price $8.50.

Engineering fundamentals and analyses applied to construction activities are the subject of this book. Author treats his subject thoroughly starting with client-engineer-constructor relationship. He follows this with the equipment and methods used in actual construction projects. Text mainly covers heavy construction. It is well illustrated and contains numerous examples. The book is not a mere enumeration of equipment but a guide applying engineering principles to the choice of construction equipment. Excavating, pile-driving, drilling, and pumping equipment are discussed. Chapters on tractors and related equipment, trucks, belt-conveyors, and cofferdams are also presented.

This book will certainly be of value to engineers engaged in power plant construction even though this subject is not discussed directly. But it probably will not help those involved in other types of utility construction.

SMOOTH BORE!



Orangeburg Fibre Conduit Prolongs Cable Life

Protect cable sheath from abrasion and you prolong the life of underground cables, say utility engineers. Scoring of cable sheath creates "trouble spots" that shorten cable life.

That's where Orangeburg Fibre Conduit plays an important part in keeping cables healthy. Orangeburg's smooth bore, its low coefficient of friction minimize the danger of abrasion when cables are pulled in, as well as later on during cable movement. By protecting cable sheath from abrasion, Orangeburg Fibre Conduit adds years to cable life.

Orangeburg's impermeable wall and watertight joints protect cables from corrosive ground waters. Its nonmetallic material is strong, tough, resilient, long lasting.

And, remember, Orangeburg lays faster and at lower cost than other types of conduit. It is light in weight, easy to handle, easy to tool on the job. Spacers, bends, fittings, 5° bend sections and lightweight tapering tool, all combine to simplify installation.

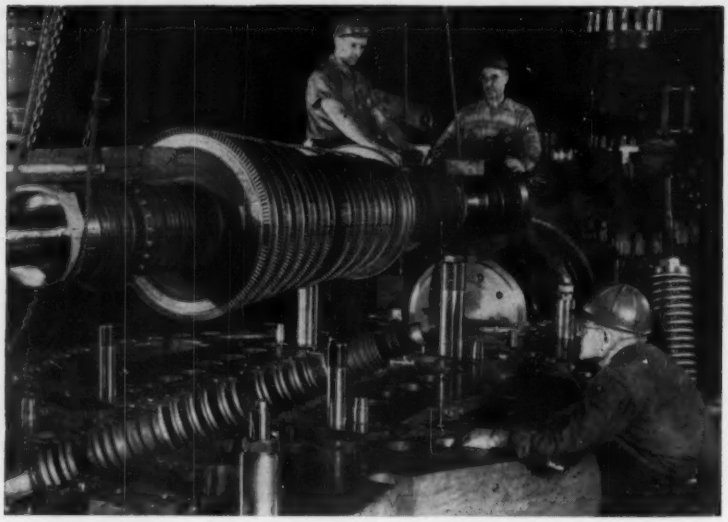
Since 1893, records of long life have proved Orangeburg's durability and economy.

Orangeburg Fibre Conduit is distributed by Graybar Electric Company and General Electric Supply Company with branches and stocks in principal cities.

WRITE DEPT. EW-46 FOR NEW CATALOG 52.

ORANGEBURG MANUFACTURING CO., INC., Orangeburg, N. Y. West Coast Plant, Newark, Calif.

ORANGEBURG®
FIBRE CONDUIT



GE Tests Supercritical Pressure Turbine

Factory tests for the first commercial supercritical pressure steam turbine-generator have begun at General Electric Co, Schenectady, N. Y. The illustration shows the seven-ton supercritical pressure element turbine rotor being leveled prior to lowering it into the turbine shell.

The unit will operate at an initial steam pressure of 4,500 psig at a temperature of 1,150 F. Highest steam pressure used by turbines now in service in the world is 2,400 psig.

This 125,000-kw steam turbine-generator is scheduled for installation this year at the Philo, Ohio, power station of the Ohio Power Co of the American Gas and Electric System.

PG&E Plans 220-Kv Aluminum Lines

Pacific Gas & Electric Co will buy 145 miles of aluminum transmission cable from Aluminum Co of America to replace existing 220-kv copper lines in northern California. Price tag for the project will be $3,025,000.

The company expects to salvage about 7-million lb of copper cable from its Pitt No. 1 and No. 2 transmission lines from Cottonwood to Vaca-Dixon substations and replace it with 4-million lb of aluminum conductor. How much the copper will bring as salvage can only be estimated, since it will go on the salvage market as the lines are replaced. The job will be done in stages to avoid interruption of service.

Work on the new 220-kv lines will start in June and completion is scheduled for the spring of 1957, according to Frank Baxter, manager of purchasing and stores for PG&E.

The new conductor will be Magnolia, 954 Mcm all-aluminum, 37 strand, 1.124 in. in over-all diameter, replacing the old copper rope-lay conductor which is about 0.91 in. in diameter. It will have considerably lower I^2R and corona losses, and afford a slight increase in capacity. The new lines will match the conductivity of a paralleling 220-kv line strung with Goldenrod 61-strand aluminum conductor.

In general, the reconductoring will require replacement of crossarms to provide greater clearances necessary for the aluminum. Four or five towers may have to be replaced. At the same time, PG&E will increase the insulation level on the line by, in most cases, adding one insulator to each string to meet the utility's standard of 15 5.75 in. insulators per string.

Aluminum was selected for the replacement job for a number of reasons, but a major consideration was the high cost of copper, Baxter reported. Other factors leading to the changeover were the advantages of reducing line losses, and elimination of radio interference. Radio problems are not traceable to the copper itself, Baxter emphasized, but to the type of cable sold for transmission purposes when the line was installed some 30 years ago.

PG&E scheduled this replacement job, Baxter said, because of special problems with the line which do not apply to the utility's other lines. Existing copper lines will not be replaced as long as they operate satisfactorily.

Anodizing Developed for Aluminum Wire

A new process of anodizing aluminum wire has been revealed by Aluminium Limited Sales, Inc. This company is the U. S. distributing subsidiary of Aluminium Limited, Montreal, Canada. The development has implications in the design of electrical motors and other electrical equipment, Aluminium reports.

In this process alternating current is said to be employed to give the wire a ductile oxide coating which in effect becomes an electrical insulation. The process involves pulling the aluminum wire through tanks containing chemical solutions which quickly give it a hard thin coating.

"Completely new horizons in design" are open to electrical equipment manufacturers as a result of this development, said Aluminium.

Electrical equipment wound with light, heat-resistant aluminum wire could be made small, cheap and light, and could run hot, it was pointed out by Aluminium.

A demand for more aluminum running into thousands of tons yearly is foreseen if aluminum wire is used as a general replacement for copper in this field.

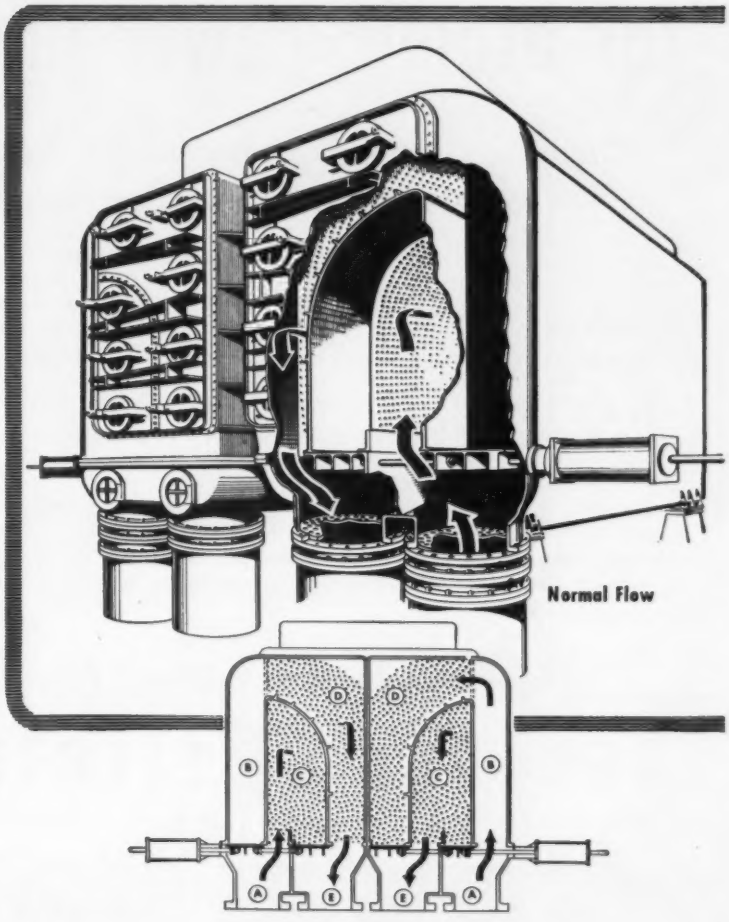
(*More M&M on page* 186)

REVERSE FLOW by C. H. WHEELER
Cleans Steam Condenser Tube Sheets Without Loss of Load

When debris and organic growth collect on the tube sheets of a C. H. Wheeler Patented Reverse Flow Steam Condenser, you don't have to shut it down for cleaning. It cleans itself—without loss of load. Sluice gates arranged within the condenser may be controlled, either electrically or hydraulically, to reverse the flow of cooling water through the tubes. This sudden reverse flow literally flushes away leaves and debris, dislodges crustaceous matter from clogged tubes.

Because of 100% water flow during back flushing, there is only a negligible dip in vacuum momentarily, thus permitting continuous load on the turbine The Reverse Flow Condenser cleans itself in minutes, compared with hours of downtime when tube sheets are manually cleaned. A typical report shows a half-inch loss of vacuum (due to fouled tubes and tube sheets) was restored in five minutes after reversing the flow of cooling water. Often, a C. H. Wheeler Reverse Flow Condenser goes two years or more without shut down for cleaning, depending on the condition of the cooling water.

New, exclusive deaerating features and construction techniques help make C. H. Wheeler Steam Condensers "First in Efficiency." Let C. H. Wheeler Custom Engineer your next steam condenser. Phone or write C. H. Wheeler Manufacturing Co., 19th & Lehigh, Philadelphia 32, Pa.... Manufacturers of Steam Power Plant Condensers • Vacuum Equipment • Marine Auxiliary Machinery • Water Supply, Drainage and Circulating Pumps.



HOW "REVERSE FLOW" WORKS

Left Side Shows Normal Operation

Water enters inlet A with right port open. Flows through tube bank C to rear of condenser . . . returns through tube bank D to front of condenser and discharges at E.

Right Side Shows Reverse Flow

Sluice gates move on a common stem. Water flows up through channel B, and through tube bank D to rear of condenser . . . returns through tube bank C to front of condenser.

In the C. H. Wheeler Divided Water Box Design, each half of the condenser can be back-flushed independently.

WE603

C.H. Wheeler OF PHILADELPHIA

General Electric offers new single-cycle BWR* for atomic power plants

Designed specifically to furnish energy for electric power generation

Forerunner of a whole new family of small power reactors, the General Electric single-cycle boiling water reactor is a new source of energy designed for power plants in a range of 5000 to 20,000 kw. It can be modified for larger ratings.

Boiling in the reactor itself and forced circulation offer these advantages:

(1) Simplified design; no main heat exchanger used. **(2)** High thermal efficiency. **(3)** Automatic control of response to load changes. **(4)** Greater safety since reactor is self-limiting in case of excessive nuclear reactivity.

This reactor uses fuel elements of the long-burn-up type. Spent fuel elements are stored in the service pool adjacent to the reactor until cool enough for further handling.

The reactor and service pool can be equipped for neutron and gamma irradiation for research without interfering with reactor operation.

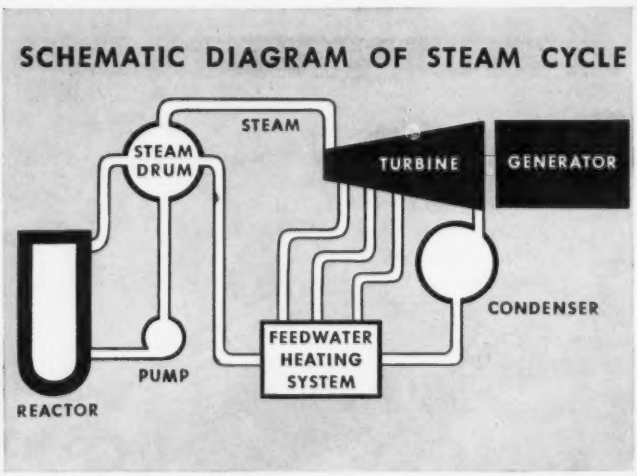
For more information, write for bulletin GER-1220, Sect. 192-7, or contact the Atomic Power Equipment Dept., General Electric Co., Schenectady 5, N. Y.

**Boiling Water Reactor*

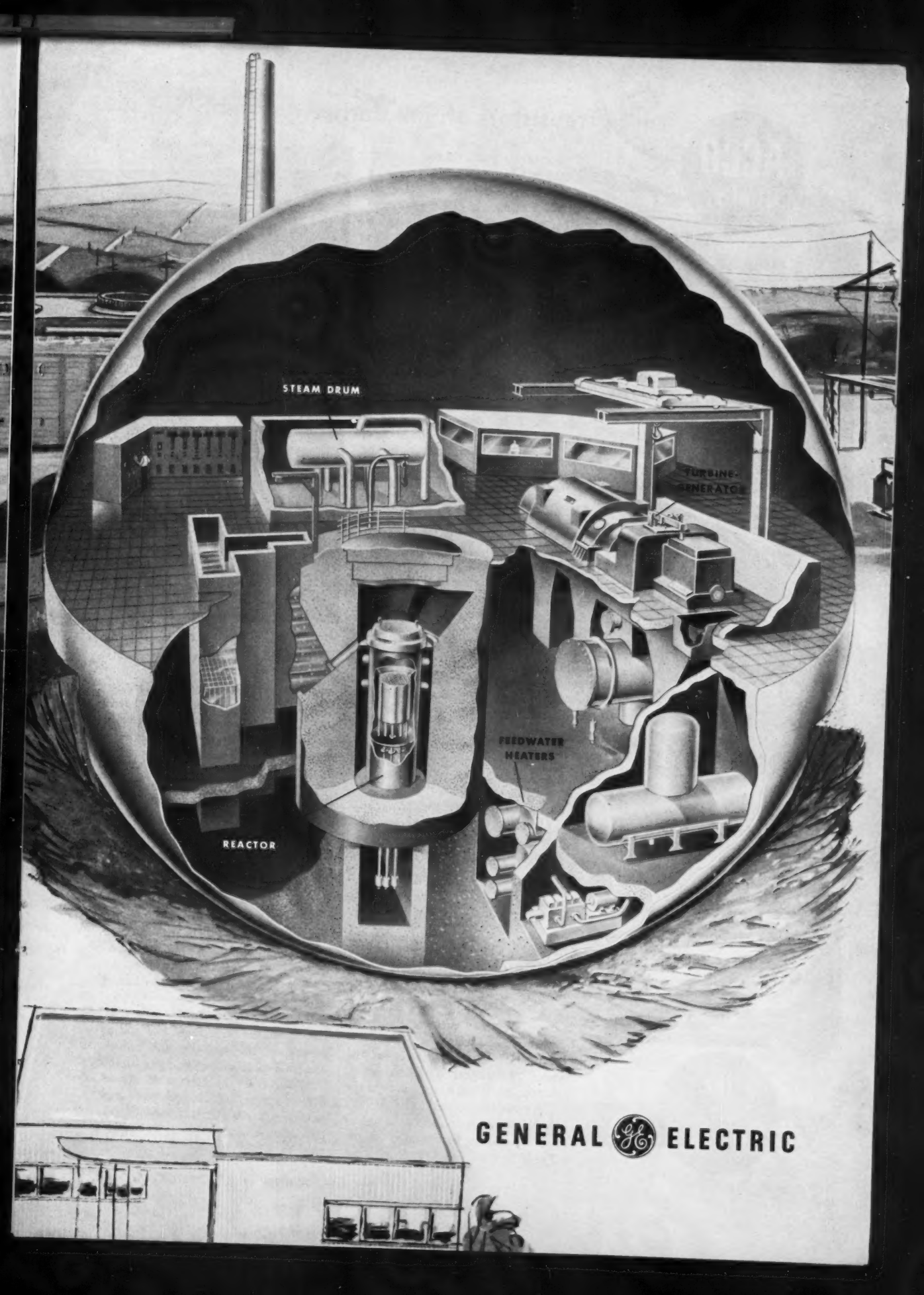
Progress Is Our Most Important Product

GENERAL ELECTRIC

SIMULATED FUEL ELEMENT being installed in a heat transfer loop for tests under reactor thermal conditions. This is one of G.E.'s supporting atomic development programs to advance reactor design.

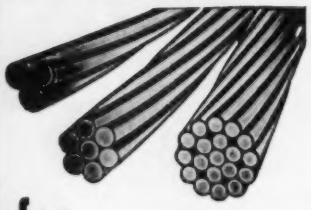


STEAM FLOWS FROM REACTOR to drum. Saturated steam passes to turbine; water goes to feedwater heaters and returns to steam drum. Forced circulation pump provides automatic control of response to load changes.


STEAM DRUM
TURBINE-GENERATOR
FEEDWATER HEATERS
REACTOR
GENERAL ELECTRIC

ACCO Quality

PAGE Stainless Steel Strand



for Severe Service Conditions

PAGE Stainless Steel Strand is equally versatile for ground, guy and catenary applications. Its higher tensile strength, corrosion-and-abrasion resistance, elastic limit and strength-to-weight ratio make it your first choice! Its lower cost per year of use means long-range economy.

Write us at Monessen, Pa., for complete information

ACCO Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Bridgeport, Conn.

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

for Better Value

Transistors Shrink Carrier Assembly

Completely transistorized power line carrier assemblies were placed in full operational service recently by Potomac Edison Co. This protective relaying equipment, believed to be the first of its kind in full operation, was designed and built by Westinghouse Electric Corp. The equipment was installed at each end of the 132-kv Marlowe-Reid line.

Westinghouse claims that use of transistors in this type of equipment has brought about lower installation, operation, and maintenance costs. The transistorized equipment is contained in a Flexitest case 22 in. high by 6 in. wide and 6 in. deep. This case is directly mounted on the switchboard, and only one adjustment need be made before the unit can be placed in operation. Vacuum tube equipment is usually contained in a 72 by 26 by 16-in. steel cabinet that requires interconnecting wiring to a relay switchboard.

Compactness of design has decreased the substation space taken by the carrier equipment. Instead of the 3 sq ft of floor space and 18 cu ft of substation space required by conventional equipment, the new units require practically no floor space and only 1 cu ft of substation space. This results in lower substation investment costs where space is at a premium.

Simplicity of design has lowered operating and maintenance costs. The transistors require no periodic checks and can be expected to last indefinitely.

The power consumption of the transistorized equipment is 18 w, while 250 w are required by conventional assemblies. This saving is realized because transistors require no filament current.

Power output is approximately one watt, but sufficient sensitivity has been provided to operate through a channel attenuation of 40 db. Previous equipment on this installation was designed for a 33-db channel.

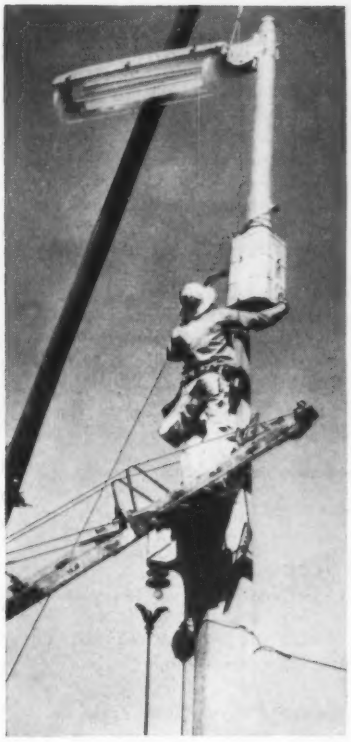
Transistorized assemblies for voice communications and phase comparison relaying are being field tested by Westinghouse on Potomac Edison lines.

Federal Pacific Develops Silver-Plated Aluminum

A process that provides an integrated surface of pure silver on aluminum bus bars has been developed by Federal Pacific Electric Co. The silver-plated bus is being produced at the Eastern Switchgear Division plant, Scranton, Pa. It has been approved for plug-in electrical connections.

By this process uniform coatings of silver are said to be obtained on the walls of drilled holes and adjacent areas where electrical connections are made, such as with copper alloy materials. This development will permit the expanded use of aluminum bus, it is reported.

R. B. Goody, Federal Pacific's research engineer, outlined the plating procedure. He said that the process consisted of careful cleaning of aluminum surfaces; the controlled deposition of special oxides; replacement of oxides with an intermediate deposition of zinc; and displacement of the zinc by silver.



Looking Up to New Lighting

Concrete pedestals were given a new look in a lighting modernization program on the High Level Bridge at Fairmont, W. Va. An 8-ft aluminum extension with 400-w fluorescent lamps was placed over the top of the pedestals to increase their over-all height from 21 ft to nearly 29 ft. Set bolts were used to tighten the castings to the concrete standards. The complete pole extension was designed by Hubbard Aluminum Products Co, Pittsburgh, Pa.

A Monongahela Power Co employe is shown guiding the extension and fixture into position. The new lighting system provides about 440,000 lumens, or nearly four times more light than the original 200-w incandescent lamps; and it utilizes only 20 of the 37 existing pedestals. The fixtures feature an adjustable mounting bracket that may be tilted from 20 to 30 deg.

This is the first phase of a five-year relighting program planned for Fairmont. Similar fixtures will be used in relighting the business district and Watson and Bellview bridges.

(*More M&M on page* 188)

1. DIGS THE HOLE!

2. LIFTS THE POLE!

3. OPERATION FINISHED!

acker digger makes pole setting as easy as 1.2.3.

The Acker Digger makes short work out of pole setting. *It digs the hole* — up to 22" in diameter. *It lifts the pole* — a built-in cathead winch easily handles loads up to 1250 lbs.

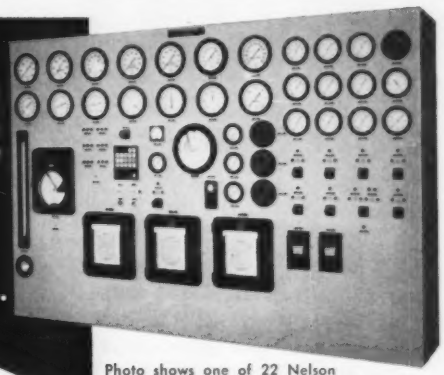
Yet, for all of its rugged, sturdy construction, its compact, lightweight design permits mounting on a small truck. And, it performs equally well on crowded city streets, or isolated open country.

Make us prove that the Acker Digger is best for you. Write for Bulletin 40.

ACKER DRILL CO., Inc. 725 W. Lackawanna Avenue Scranton, Penna.

Manufacturers of a complete line of Diamond and Shot Core Drills, Drilling Accessories and Equipment

YOU SURE
SAVE TIME
on the purchase and installation of NELSON control boards....



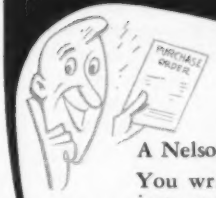


Photo shows one of 22 Nelson control boards which were recently built for a large utility.

A Nelson control board is a turn-key job.

You write *one* purchase order. We procure all of the instruments; do all of the sheet metal work, all of the welding, all of the wiring, all of the piping, and all of the testing.

The control board is shipped to your plant as *a completed assembly.* Installation time is reduced to a minimum. The next time you need a control board, let us quote on your requirements.

Write for Bulletin No. 712.

NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA

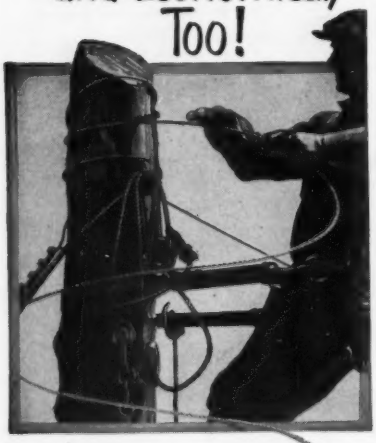
Crapo
GALVANIZED STEEL
STRAND

Strong...
to support pole structures under adverse ice and wind loadings.

Rugged...
to withstand the punishment incurred in construction and service.

Long-Life...
provided by famous Crapo Galvanized heavy, ductile, tightly-bonded zinc coatings.

and Economical, Too!



● Each size and grade of time-proved Crapo Steel Strand utilizes the superior tensile strength of steel to the fullest advantage. Next time, specify Crapo Steel Strand for guys, messenger and overhead ground wires . . . and *save on maintenance!*

REINFORCE and PROTECT YOUR CONDUCTORS with Preformed ARMOR RODS

Minimize wear and chafing . . . Absorb and dissipate vibration . . . Protect against arcing and flash-overs . . . Increase holding power against slippage . . Lessen possibilities of corrosion . . . *Reduce overall maintenance costs.*

Contact your jobber of Crapo Galvanized Products or write direct for further information!

INDIANA
STEEL & WIRE COMPANY
MUNCIE, INDIANA

Russia Claims Short-Time Boiler Assembly

Russia makes another claim—now it's installing boilers.

Russia can assemble boilers in four months, Georgi M. Malenkov declared, while on his recent tour of British power installations. The Soviet Minister of Electric Power Stations made this bold statement when he was informed that the British needed 18 months to assemble boilers.

But Malenkov overlooked two items—he did not mention the size of the Soviet boilers nor define "assemble."

Russia's largest steam turbine-generator is about 60,000 kw, according to data available in the United States.

Information gleaned from steam-generator manufacturers in this country indicates that boilers for 60,000-kw turbine-generators can be assembled in about eight months (from the time the boiler foundation is ready until the boiler is in operation. Boiler assembly for 100,000-kw turbine-generators is 10 to 12 months and for 150,000 to 250,000-kw units about 12 to 14 months. Small boilers of about 75,000 to 150,000 lb per hr ratings can be assembled on the site in about 3 to 4 months; packaged units of 50,000 lb per hr, in one day.

M&M BRIEFS

R/W Maintenance Service, a Division of Osmose Wood Preserving Co of America, Inc, is the new name for R/W Maintenance Corp. The latter was merged recently with its parent. Personnel and technical methods remain unchanged.

Micro Switch, a division of Minneapolis-Honeywell Regulator Co, has opened a plant near Independence, Iowa. The new building was financed by a community corporation known as the Independence Building Corp and was built for lease to the Honeywell division. Micro Switch, maintains executive headquarters and production facilities in Freeport, Ill., and also has a factory at Warren, Ill.

Babcock & Wilcox Co will build and install a "swimming pool" type atomic research reactor for Brazil's Comissao de Engergia Atomica, the Brazilian equivalent of the U. S. Atomic Energy Commission. This unit, rated 5,000 kw heat output, is reported to be the first of this type reactor ordered from a U. S. manufacturer by a Latin American nation. AEC will furnish fuel by agreement.

Metal & Thermit Corp, New York, has acquired the Glenn Co, Oakland, Calif., which will be operated as a manufacturing subsidiary under the name M&T Welding Products Corp. Glenn produces constant voltage power sources, welding wire feeding devices and other devices. H. E. Martin is president of the newly formed corporation.

Borden Co of New York has acquired Resin Industries of Santa Barbara, Calif., which will be operated as a wholly owned subsidiary. There will be no changes in management or personnel. Resin Industries is a supplier of plastic sleeving and tubing.

Worthington Corp has a new division by merger of the Mason-Neilan Regulator Co of Boston, Mass. Latter's control valves and regulators are complementary equipment for Worthington pumps, compressors, turbines and other machinery. Net assets, name and goodwill of Mason-Neilan were exchanged for Worthington common stock.

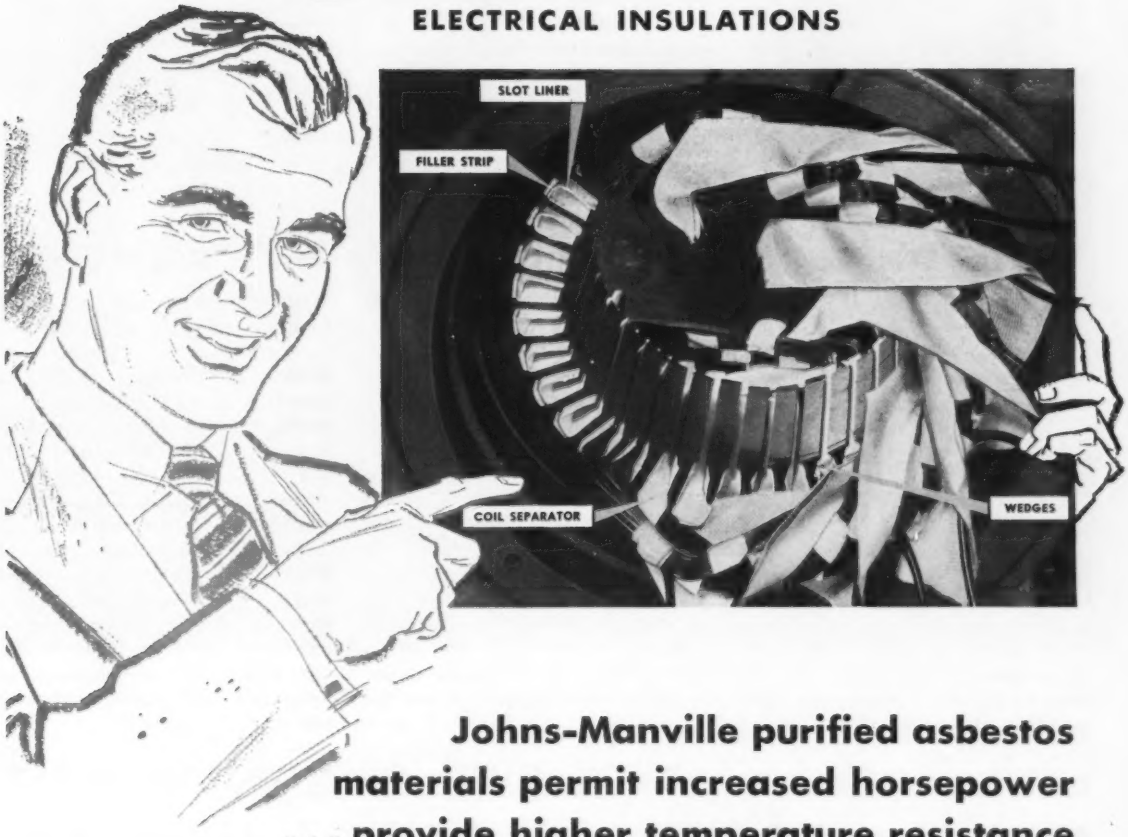
Stone & Webster Engineering Corp has been authorized to proceed with construction of Unit No. 6 at the Rio Grande station of El Paso Electric Co. The 44,000 kw turbine-generator will be supplied with steam at 850 psi, 900 F from a gas or oil fired, 470,000-lb per hr steam generator. Cooling water towers will be included and will be supplied with water from deep wells.

Haddam Manufacturing Co, Yorktown Heights, N. Y., reports developing a new method of bonding copper and copper alloys to glass. The metal is bonded at a temperature in excess of the melting point of copper.

Smaller motors carry bigger loads when you insulate with

Quinterra®

ELECTRICAL INSULATIONS



Johns-Manville purified asbestos materials permit increased horsepower . . . provide higher temperature resistance

MOTORS insulated with Quinterra will outperform others of substantially higher rating but with less heat-resistant insulation.

The above photograph shows how you can use *Quinterra* and its companion product *Quinterrabord*® on a standard Class H induction motor. *Quinterra* Type 3-GR was employed for slot liners and coil separators. Wedges and filler strips are of *Quinterrabord* Type 3. Both materials are made from highly purified asbestos fibres treated with silicone resin for the highest combination of dielectric strength and pyrolysis resistance obtainable. In addition, Type 3-GR is reinforced with a strengthening layer of fine glass cloth.

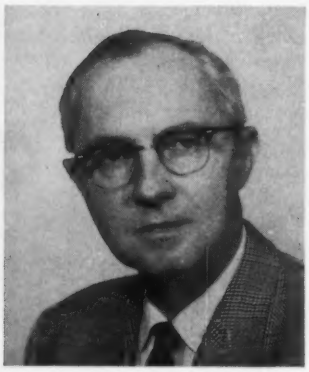
Johns-Manville has developed a complete line of *Quinterra* materials for application in motors, transformers and other electrical apparatus. For further information write for brochure EL-40A. Address Johns-Manville, Box 60, New York 16, N. Y. In Canada, Port Credit, Ontario.

JOHNS-MANVILLE JM PRODUCTS **Johns-Manville ELECTRICAL INSULATIONS**

NEWS ABOUT PEOPLE

G. W. EVANS

S. J. SICKEL



F. M. KIMBALL

Evans to Head KG&E Board, Two VP's Elected

G. W. Evans, president of Kansas Gas & Electric Co since 1953, has been elected chairman of the board to replace Murray F. Gill whose resignation from that post becomes effective April 30. Gill remains a director of the utility. In other executive promotions, S. J. Sickel was elected to the newly created office of vice president of operations and F. M. Kimball was named vice president in charge of sales.

Evans, who continues as president, has been associated with KG&E since 1947 when he joined as a director and as assistant to the president. He was elevated to vice president the same year and vice president and general manager in 1949. A veteran of more than 30 years in the utility management field, Evans started his career in 1924 with Public Service Co of Oklahoma. Since that time he has served in various capacities with other operating companies in the utility industry, including vice president of Oklahoma Power & Water Co and vice president of the Missouri Public Service Corp. He came to KG&E from a position he had held since 1941 as president of the Missouri Edison Co and of the East Missouri Power Co.

In addition to his former duties as general superintendent, a post he has held since 1952, Sickel will have charge of production and engineering. Prior to joining KG&E in 1950 as assistant superintendent of operations, his entire professional career had been spent with Northwestern Public Service Co. While there he advanced from power plant helper to superintendent of transmission and distribution.

Kimball, new vice president of sales, joined KG&E in 1949 as general sales manager and is a 25-year veteran of utility sales work. Prior to joining KG&E he was sales promotion manager with the Portland Gas & Coke Co.

J. A. Elgaard, administrative assistant since 1952, has been appointed assistant to the president.

Nantucket G&E Elevates Prichard, Macomber

C. R. PRICHARD

New president of Nantucket Gas & Electric Co, succeeding the late W. L. Mather, is Charles R. Prichard, also president of Manchester Electric Co. George A. Macomber, president of Cambridge Trust Co and a Nantucket G&E director, has been elected vice president.

Prichard, who attended Dartmouth College and Massachusetts Institute of Technology, joined the utility in 1930 and became treasurer in 1934. He was recently re-elected treasurer of the company and is also president of Gas Service, Inc., Nashua, N. H.

Other executive promotions include Charles G. Snow's rise from general superintendent, electric and gas departments, to general manager. Paul V. Hoadley is new assistant treasurer.

G. A. MACOMBER

He's coming to help you

He is a Bell System communications engineer. His purpose is to help you speed your operations, cut your costs and improve your service—by making sure your communications meet your exact requirements.

The Bell System offers a wide variety of private line services, including telephone, teletypewriter and mobile radio systems. And the Bell System tailors these facilities to meet specific individual needs, so that you maintain high-speed contact between your various departments, branches, factories, warehouses, as well as between you and your suppliers, customers, distributors and shippers.

Why not let a Bell System communications engineer make a study of your communications requirements and recommend the kind of service, or a combination of services, which will best meet your specific needs?

• • •

His survey is free and his recommendations are yours without obligation. You can reach him by calling your nearest Bell Telephone business office.

BELL TELEPHONE SYSTEM

United Illuminating Advances Cooper, Betts

William J. Cooper has been elected executive vice president and John M. C. Betts vice president and secretary of United Illuminating Co, Conn.

Cooper, a graduate of Georgia Institute of Technology and Yale University, is former vice president of operations. Since joining the utility in 1942 he has served as assistant to the treasurer, director of employee relations, and assistant to the president. He previously was with Georgia Power Co, Central Hudson Gas & Electric Corp, and Line Material Co.

Betts joined United Illuminating in 1940 as assistant secretary and assistant treasurer. He has been secretary and assistant treasurer, and since 1951 assistant to the president and secretary.

W. J. COOPER

J. M. C. BETTS

E. H. HOWELL

Howell Elected GE Commercial VP

General Electric Co has announced the election of Edwin H. Howell as a commercial vice president with headquarters in Dallas, Texas.

Associated with the company for 34 years in various sales and engineering capacities, principally in the Midwestern area, Howell most recently served as district manager of GE's User Industries Sales Department in Cleveland, Ohio.

As commercial vice president he will have broad responsibility for GE customer relations in the Southwestern area, including the states of Texas, Oklahoma, Louisiana, New Mexico, and parts of Arkansas.

PERSONAL BRIEFS

J. Norris Pearson, formerly project engineer for construction of a steam power plant at Kodiak, Alaska, has been appointed as one of the chief mechanical engineers of Tacoma, Wash., City Light. He succeeds **Francis H. Murray.**

New electric production and transmission manager for Central Illinois Light Co is **Oscar L. Sundstrom,** chief engineer at the utility's R. S. Wallace station since 1949.

Toledo Edison Co's **Frederick R. Miller,** formerly associate engineer, has been advanced to transmission and substation planning engineer in the electrical engineering department. Former senior assistant engineer **Arthur P. Sussman** becomes associate engineer in the meter department.

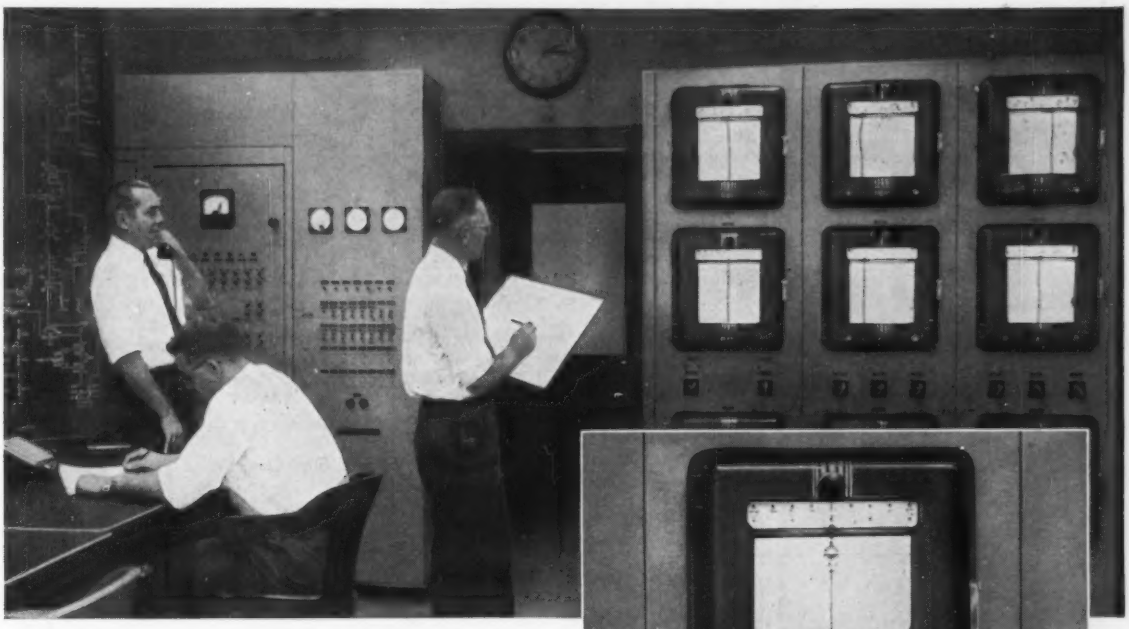
In conjunction with the expansion of its national sales structure, Motorola Communications & Electronics, Inc, has established four sales divisions and appointed six vice presidents. **Arthur L. Reese,** assistant secretary, becomes vice president and operations manager, and **Eugene S. Goebel,** formerly national sales manager, is new vice president for market relations. Four former regional managers were also appointed vice presidents and placed in charge of the following new sales divisions: **Lowell E. White,** Eastern Sales Division; **Homer L. Marrs,** Central; **Edward L. Falls, Jr.,** Southern; and **Donald F. Brickley,** Western.

Arthur G. Curtin has been named Midwest regional manager of BullDog Electric Products Co to replace **Merle P. Spurrell,** recently named general sales manager.

Harry N. Cantrell has been appointed supervisor of the new computational research component of General Electric Co's Large Steam Turbine-Generator Department . . . Recently named manager of GE's marketing specialization consulting service was **Hershner Cross,** former general manager of the company's Distribution Assemblies Department . . . Electronics Division has designated **Russell E. Norem** as manager of finance for its communication equipment section.

OBITUARY

Dr. Eugene C. Crittenden, 75, consultant to the director of National Bureau of Standards and former associate director of the agency, died recently in Washington, D. C. An expert on standards of physical measurement, Dr. Crittendon was instrumental in establishing the system of electrical units which provides the basis for electrical measurement throughout the world. He was the 1946 recipient of the Illuminating Engineering Society's gold medal.



200 MW SYSTEM JOINS TREND TO AUTOMATION WITH "BIG SYSTEM" AUTOMATIC LOAD CONTROL

Operating Advantages and Savings Proportionate To Those Gained On Multi-Million KW Systems

This Central Hudson Gas & Electric Net Interchange Deviation Recorder (middle instrument at left end of panel) gives operators two chart curves: scheduled interchange of power with neighboring systems and deviations from the schedule. For 3 hours prior to this photo, all normal ties had been closed with the scheduled interchange at zero. Because control held the schedule accurately, the two curves coincide.

• Operating and management people on many progressive small systems have found that the principles of automatic tie-line bias control are just as applicable as on the larger power networks. Example: the experience of the Central Hudson Gas & Electric Corporation of Poughkeepsie, New York.

Before they installed automatic load control, their operators did a remarkable job of mentally calculating all the variables which must be considered in order to keep generation and demand economically in step. But "remarkable" was not good enough, because they realized that with an accelerated load growth, and the advances made in automatic dispatching, CHG&E could do still better.

They did. With the installation of automatic load control, many operating problems disappeared. Operators now meet their tie-line interchange schedules accurately — and, as a matter of fact, their regulating error is less than one per cent. Their control lets them get the full benefit of interconnected operation, and at the same time, avoid the needless and excessive upsets which could occur if their automatic system control were not in operation.

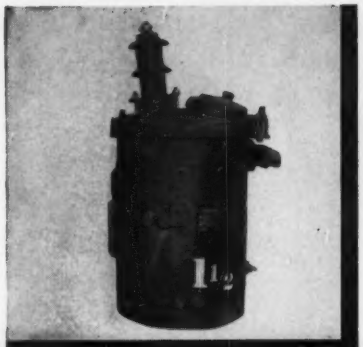
And, that's only part of the story. Today, boiler pressure and drum level fluctuations occur less frequently, and are much milder. Even the amount of telephoning between dispatchers and generating plants is less than it would otherwise be.

Naturally, we're proud of the performance of this additional Leeds & Northrup Load-Frequency Control installation. May we suggest that you can similarly move ahead by talking with L&N engineers about your own operating picture. We'd like to emphasize that these men are all seasoned load-control specialists who have a long list of successfully operating control installations to their credit.

LEEDS **NORTHRUP**

300 Load-Frequency Control Installations 1927-55

4938 Stenton Avenue, Phila. 44, Pa.



1½ kva too small?

G-E Service Shop

uprates to 5 kva!

There's lots of life in your old distribution transformers yet! Just let your local G-E Service Shop replace the old cores and coils with new factory-built units of higher kva capacity. Your transformers are returned good as new. There are 31 G-E Service Shops throughout the country—one near you. 431-33

Progress Is Our Most Important Product

GENERAL ELECTRIC

SALES ASSIGNMENTS

COMPANY STAFFS

Allis-Chalmers Manufacturing Co's Industries Group has appointed Harvey D. Hill, James H. Stoltz, and Robert W. Venn as sales representatives at the Cleveland, Pittsburgh, and Chicago district offices, respectively.

Copperweld Steel Co has named Maskell E. Brown to succeed Henry Oberle as sales engineer in eastern Pennsylvania, New Jersey and New York City.

Electric Machinery Manufacturing Co's new manager of New York sales is James J. Wall, who will be responsible for all E-M sales and application engineering in the New York and upper New Jersey area. P. L. Shawley continues as district manager for Boston and Syracuse in addition to his New York duties.

General Electric Co has designated J. William Stone outdoor lighting specialist for the Apparatus Sales Division in the Southeastern district. . . . Philip J. Robinson has been transferred from Chicago to Detroit, Mich., to serve as manager of GE electric utility sales operations.

General Electric Supply Co has appointed R. S. Belnap as head of its new Intermountain Region which includes the former Denver and Salt Lake districts.

Graybar Electric Co, Inc, has named J. H. Pearson, III, manager in the Memphis area to replace Wayne J. Berry who becomes Southeastern district manager.

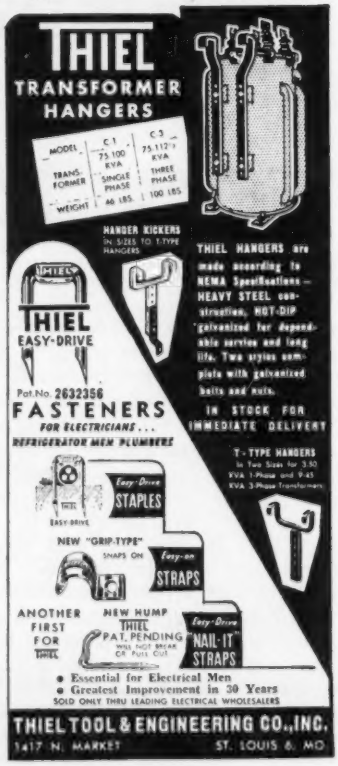
Kaiser Aluminum & Chemical Sales, Inc, has designated Edward H. Bastedo northwest district representative in Spokane to work with electrical wholesalers in Washington, Oregon, Montana, and northern Idaho.

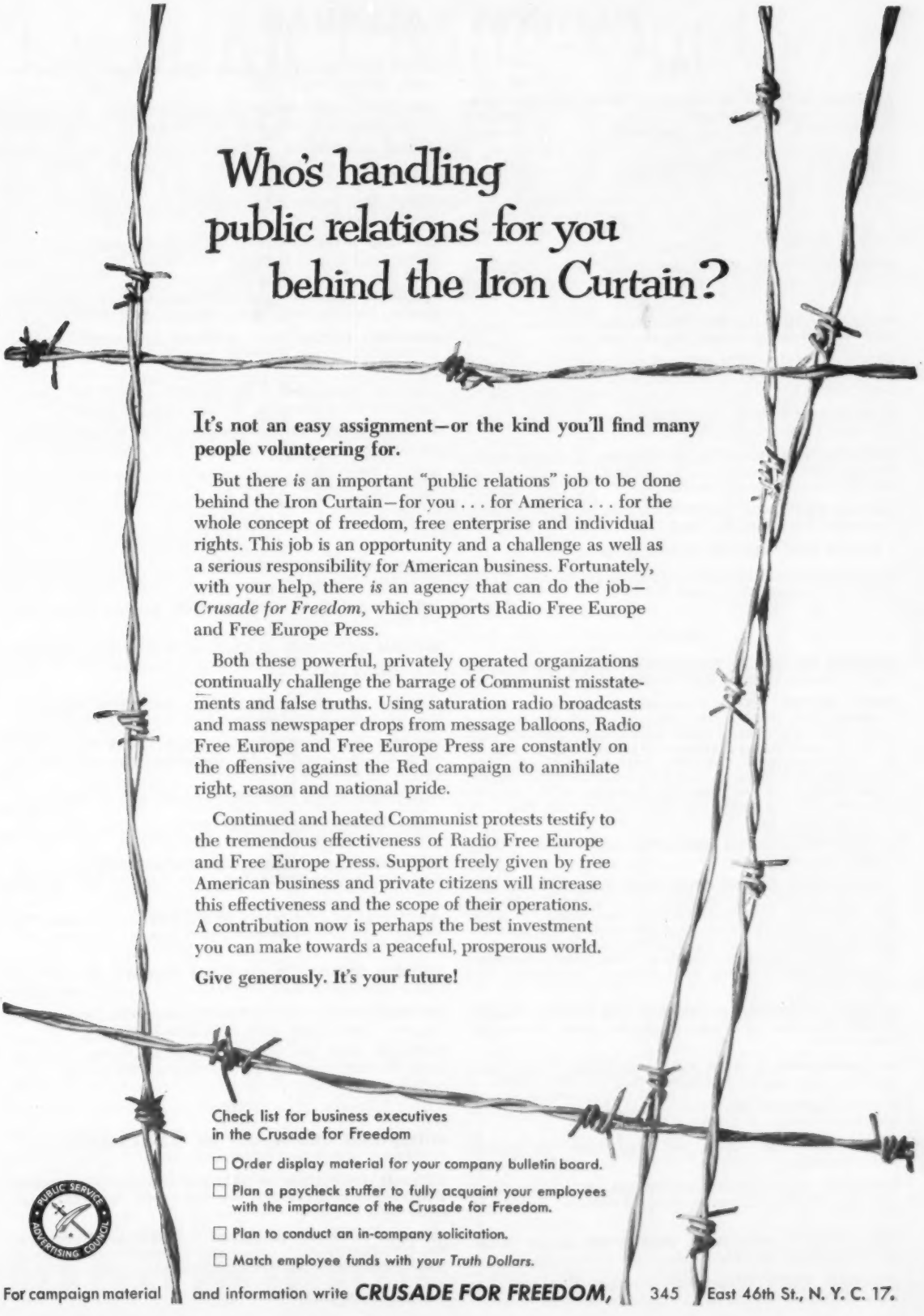
Miller Co, Conn., has announced the appointment of Robert W. Ellis as sales representative for its Illuminating Division in eastern Massachusetts, New Hampshire's Rockingham County, and the State of Maine.

Thomas & Betts Co's organizational changes in the Eastern and Western Sales Divisions include appointment of three new district managers for the Eastern Division—Eugene McGrane, Boston; Rex Pearson, New York; and Hugh Holcombe, Atlanta. In the Western Division, John Clark becomes specialist for the company's utility and Sta-Kon products; William Risberg is new Chicago district manager for the Chicago, Milwaukee, Indianapolis, and Minneapolis territories; and James Boyle is Kansas City district manager for Kansas City, St. Louis, Davenport, and Denver.

REPRESENTATIVES

Robertshaw-Fulton Controls Co's Fielden Instrument Division has appointed the H. G. Klug Co to handle sales of its products in eastern and central Iowa, in addition to the western part of the state.





Who's handling public relations for you behind the Iron Curtain?

It's not an easy assignment—or the kind you'll find many people volunteering for.

But there *is* an important "public relations" job to be done behind the Iron Curtain—for you . . . for America . . . for the whole concept of freedom, free enterprise and individual rights. This job is an opportunity and a challenge as well as a serious responsibility for American business. Fortunately, with your help, there *is* an agency that can do the job—*Crusade for Freedom*, which supports Radio Free Europe and Free Europe Press.

Both these powerful, privately operated organizations continually challenge the barrage of Communist misstatements and false truths. Using saturation radio broadcasts and mass newspaper drops from message balloons, Radio Free Europe and Free Europe Press are constantly on the offensive against the Red campaign to annihilate right, reason and national pride.

Continued and heated Communist protests testify to the tremendous effectiveness of Radio Free Europe and Free Europe Press. Support freely given by free American business and private citizens will increase this effectiveness and the scope of their operations. A contribution now is perhaps the best investment you can make towards a peaceful, prosperous world.

Give generously. It's your future!

Check list for business executives in the Crusade for Freedom

- ☐ Order display material for your company bulletin board.
- ☐ Plan a paycheck stuffer to fully acquaint your employees with the importance of the Crusade for Freedom.
- ☐ Plan to conduct an in-company solicitation.
- ☐ Match employee funds with *your Truth Dollars.*

PUBLIC SERVICE ADVERTISING COUNCIL

For campaign material and information write **CRUSADE FOR FREEDOM,** 345 East 46th St., N. Y. C. 17.

MEETINGS CALENDAR

APRIL

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Great Lakes District, Fort Wayne, Ind., April 16-18; Technical Conference, Bradford Hotel, Boston, Mass., April 26-27.

EDISON ELECTRIC INSTITUTE—National Conference of Electric & Gas Utility Accountants, sponsored jointly with AGA, Hotel Commodore, N. Y. C., April 16-18; Industrial Relations Committee, EEI Headquarters, N. Y. C., April 19; Engineering Committees, (Electric Equipment & Metering Service, Prime Movers, Transmission & Distribution, and Hydraulic) Edgewater Beach Hotel, Chicago, April 30-May 2.

ATOMIC INDUSTRIAL FORUM, INC—Atomic Energy Conference, Atlantic-Biltmore Hotel, Atlanta, Ga., & Oak Ridge, Tenn., April 17-18.

MISSOURI VALLEY ELECTRIC ASSOCIATION—Engineering Conference, Hotel President, Kansas City, Mo., April 18-20.

PACIFIC COAST ELECTRICAL ASSOCIATION—Administrative Services Section Meeting, Huntington-Sheraton Hotel, Pasadena, Calif., April 18-20.

PENNSYLVANIA ELECTRIC ASSOCIATION—Meter Committee, Roosevelt Hotel, Pittsburgh, Pa., April 19-20.

PROTECTIVE RELAY ENGINEERS—Ninth Annual Conference, Department of Electrical Engineering, Agricultural and Mechanical College of Texas, College Station, April 23-25.

VIRGINIA POLYTECHNIC INSTITUTE—Seventh Annual Engineering Conference, Blacksburg, Va., April 26-28.

* **GERMAN INDUSTRIES FAIR**—Hanover, Germany, April 29.

ROCKY MOUNTAIN ELECTRICAL LEAGUE—Spring Meeting, Shirley-Savoy Hotel, Denver, Colo., April 29-May 1.

MAY

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—North Eastern District Meeting, Sheraton Hotel, Rochester, New York, May 2-4.

EDISON ELECTRIC INSTITUTE—Accident Prevention Committee, Coronado Hotel, St. Louis, Mo., May 2-4; Purchasing & Stores Committee, Sheraton Plaza Hotel, Boston, Mass., May 7-9; Commercial Electric Cooking Conference, Sheraton Hotel, Chicago, Ill., May 8; Transportation Committee Meeting, jointly with AGA, Congress Hotel, Chicago, Ill, May 8-11; Industrial Relations Committee, Willis E. Hughes Memorial, Rochester, N. Y., May 17; Orientation Meeting, jointly with AGA, Headquarters, New York, N. Y., May 21.

NATIONAL FARM WIRING CONFERENCE—LaSalle Hotel, Chicago, Ill., May 3-4.

* **PENNSYLVANIA ELECTRIC ASSOCIATION**—Hydraulic Power Committee, Hotel Warwick, Philadelphia, Pa., May 3-4; Transmission and Distribution Committee, Skytop Lodge, Skytop, Pa., May 10-11; Communications Committee, Nittany Lion Inn, State College, Pa., May 14-15; Relay and Electrical Equipment Committees, Hotel Roosevelt, Pittsburgh, Pa., May 17-18; Systems Operations Committee, Bedford Springs Hotel, Bedford, Pennsylvania, May 24-25.

NATIONAL ASSOCIATION OF RAILROAD AND UTILITIES COMMISSIONERS—Executive Committee, Leamington Hotel, Minneapolis, Minn., May 4.

AIR-CONDITIONING & REFRIGERATION INSTITUTE—Annual Meeting, The Homestead, Hot Springs, Va., May 7-9.

AMERICAN WELDING SOCIETY—Fourth Welding Show, Memorial Auditorium, Buffalo, N. Y., May 9-11.

ATOMIC INDUSTRIAL FORUM, INC—Hotel Plaza, San Antonio, Texas, May 10-11.

NORTHWEST PUBLIC POWER ASSOCIATION, INC—Engineering & Operations Section, Cascadian Hotel, Wenatchee, Washington, May 10-11.

PUBLIC UTILITIES ADVERTISING ASSOCIATION—Annual Convention, Philadelphia, Pa., May 10-11.

INTERSTATE POWER CLUB—Hotel Martinique, New York City, N. Y., May 14.

PACIFIC COAST ELECTRICAL ASSOCIATION—Annual Convention, Las Vegas, Nevada, May 14-16.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Design Engineering Conference, Convention Hall, Philadelphia, Pa., May 14-17.

ILLINOIS INSTITUTE OF TECHNOLOGY—Industrial Nuclear Technology Conference, Museum of Science & Industry, Chicago, Ill., May 15-16.

GREAT LAKES POWER CLUB—Wagon Wheel Hotel, Rockton, Ill., May 17-18.

NEW YORK STATE SOCIETY OF PROFESSIONAL ENGINEERS—30th Engineering Industries Exposition with Annual Convention, Statler Hotel, New York City, May 17-19.

INDUSTRIAL HEATING EQUIPMENT ASSOCIATION, INC—Spring Meeting, The Homestead, Hot Springs, Va., May 20-23.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION—Business Developments Section, Benjamin Franklin Hotel, Seattle, Wash., May 21-23.

AMERICAN MANAGEMENT ASSOCIATION—General Management Conference, Hotel Roosevelt, New York City, May 23-25.

NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS—Annual Meeting, Ambassador Hotel, Atlantic City, N. J., May 23-26.

CIGRE—16th Annual International Conference, Paris, France, May 30-June 9.

JUNE

EDISON ELECTRIC INSTITUTE—24th Annual Convention, Traymore Hotel, Atlantic City, June 4-6.

AMERICAN SOCIETY OF CIVIL ENGINEERS—National Spring Meeting, Knoxville, Tenn., June 4-8.

NATIONAL ASSOCIATION OF ELECTRICAL DISTRIBUTORS—48th Annual Convention, Ambassador & Chelsea Hotels, Atlantic City, N. J., June 11-14.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Semi-Annual Meeting, Statler Hotel, Cleveland, Ohio, June 17-21.

AMERICAN SOCIETY OF TESTING MATERIALS—59th Annual Meeting & 12th Apparatus Exhibit, Chalfonte-Haddon Hall, Atlantic City, N. J., June 17-22.

FIFTH WORLD POWER CONFERENCE—Vienna, Austria, June 17-23.

* **CANADIAN ELECTRICAL ASSOCIATION**—Annual Convention, Manoir Richelieu, Murray Bay, Quebec, June 18-20.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION—Accounting & Business Practice Section, Multnomah Hotel, Portland, Oregon, June 21-23.

PUBLIC UTILITIES ASSOCIATION OF THE VIRGINIAS—Accident Prevention Committee Conference, Hotel Roanoke, Roanoke, Va., June 22.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Summer and Pacific General Meetings, San Francisco, California, June 25-29.

AMERICAN SOCIETY FOR ENGINEERING EDUCATION—Annual Meeting, Iowa State College, Ames, Iowa, June 25-29.

AMERICAN CHIEF ENGINEERS ASSOCIATION—Northwest Power Show, Minneapolis Auditorium, Minneapolis, June 28-July 1.

JULY

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION—Council Meeting, Geneva, Switzerland, July 16-21.

NATIONAL ASSOCIATION OF RAILROAD AND UTILITIES COMMISSIONERS—Annual Convention, Sheraton Palace Hotel, San Francisco, Calif., July 24-27.

COLUMBIA UNIVERSITY INDUSTRIAL & MANAGEMENT ENGINEERING DEPARTMENT—Fifth Annual Utility Management Workshop, Arden House, Harriman, New York, July 29-Aug. 10.

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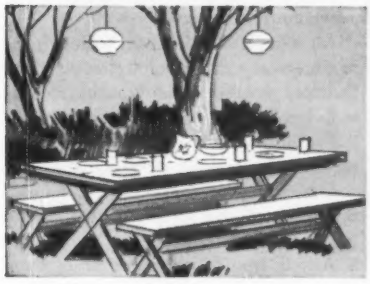
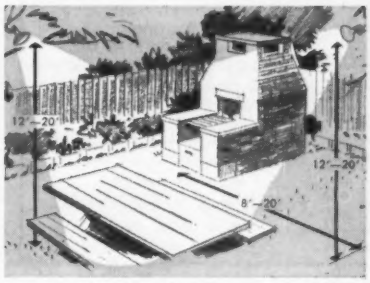
* Additions this week.

"Light for Living–Outdoors"

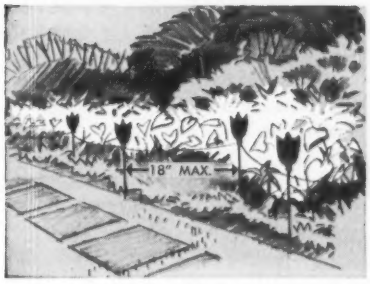


For Dining

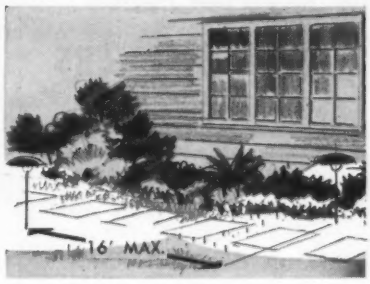


For Barbecues

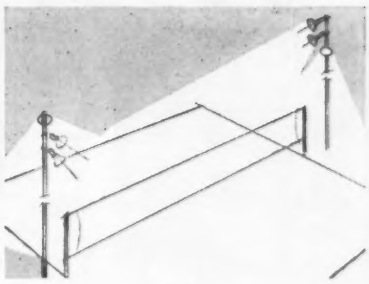
For Terraces



For Flowers



For Walks



For Games

Load-builder for off-peak hours!

Light for Living is moving outdoors—giving you a real load-builder in a big new area of residential lighting. It's your chance to light up yards and gardens . . . walks and drives . . . porches . . . terraces . . . barbecues . . . play areas—*and increase the uses of electricity during off-peak hours!*

Every year more families are enjoying more evenings outdoors. It's the economical way to expand living space; the easy, relaxed way to entertain.

G-E's award-winning "MEDIC" show is giving a big push to *Light for Living—Outdoors.* And leading magazine editors, quick to spot the nationwide interest in the subject, are devoting many editorials to *Light for Living—Outdoors.* So, take advantage of all this fine publicity by making liberal use of *Light for Living—Outdoors* in your own Live Better Electrically program. Plan your advertising and promotion to stimulate consumer interest—and solicit promotion tie-ins with all elements of the lighting industry in your area. Then watch how *Light for Living—Outdoors* helps take up the slack . . . and step-up the use of residential KWH during off-peak hours!

This new book has numerous lighting recipes that show how to get full use and enjoyment from all outdoors. Send for a sample book today—and get quotations on quantities. Use 'em as give-aways; feature them in your promotion programs; use them as guides in counseling your customers on their outside lighting plans.

Progress Is Our Most Important Product

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY
Large Lamp Dept. EW-4
Nela Park, Cleveland 12, Ohio

Send me a sample copy of "Light for Living—Outdoors", and prices on these in quantity.

NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ ZONE_____ STATE_____

F & H Self-Powered
HOLE DIGGER

The modern way to dig holes. No expensive installation. Fits on any A frame. Equipped to dig holes 8' deep and up to 20" in diameter. One man operates digger as all controls are mounted on machine. Available in 8-HP and 14-HP models. Auger is cleaned by spinning. Digs anchor holes with ease. Write for full information. Film of machine in operation available on request.

Manufactured by
FOUSHEE & HECKENDORN
P. O. BOX 65,
CEDAR POINT, KANSAS

Serving the Utilities that Serve the Nation

PREMAX POLE MARKERS

Linemen and plant crews identify trouble areas fast with easy-to-read Premax Markers. Designed for high legibility in weatherproof aluminum or brass, Premax letters, figures, tags and special marking devices are the choice of utilities across the nation.

R.E.A. Approved. Ask your jobber, or write

PREMAX PRODUCTS Div. Chisholm-Ryder Co. Inc.
5648 Highland Ave., Niagara Falls, N. Y.

?

WHAT'S NEW?

We're interested . . . and so are Electrical World's readers! Are you all steamed up about your new product, new plant or expanded facilities? Got some red-hot new literature, research results or a new production method? Any financial, product design changes —shifts in executive personnel—consolidations? Whatever you have, *World* makes it easy to bring it to the reader's attention. Write for the booklet . . . *"How To Get Maximum Value Out of The News Releases You Write For Electrical World."*

Influences Philo Design

(*Continued from page* 94)

1 to 8 has a local sampling coil for taking spot samples for iron and copper determinations.

All sample conductivity values are recorded on a multi-point conductivity recorder in the main control room. Individual automatic temperature compensation is provided for all points. A second single-point conductivity recorder-controller is for chemical feed pump control, the sample control point being selected as desired.

A single-point pH recorder is also provided with provisions for selecting the sample to be measured. Control equipment is provided so that pH characteristics may be used for chemical feed pump operation.

Three dissolved hydrogen analyzers have been installed for continuously monitoring hydrogen evolution from the steam generator. Any selected three of the steam generator sample points may be recorded simultaneously in the main control room.

A two-point dissolved oxygen recorder in the control room will continuously record the oxygen content of condensate and feedwater.

Pre-operating Cleanout Planned

Because of the rigid water characteristics imposed, it became apparent early that special considerations of cycle cleanliness would be required before initial operation. These have been worked out in detail, and piping design has been modified where necessary to suit the requirements. In outline, the successive steps will be these:

1. Thorough flushing of all piping.

2. Circulation of hot caustic-phosphate solution through steam generator and start-up system to condenser and return.

3. Drain and high velocity flush to waste.

4. Fill condensate-feedwater system with inhibited acid at suitable temperature.

5. Displace acid to waste with water.

6. Drain and high velocity flush to waste through steam generator.

7. Circulation of passivating solution as in 2.

8. Drain and flush to waste as in 6.

9. Circulate inhibited acid through steam generator to chemical cleaning tank.

10. Displace acid to waste.

(*Continued on page* 199)

Influences Philo Design

(*Continued from page* 198)

11. High velocity flush to waste.

12. Circulate with pH of water adjusted to desired level and bypass demineralization until water in cycle corresponds to operating specifications.

13. Blow out reheaters with auxiliary steam.

14. During initial roll of turbine, discard all heater drains for additional cleaning of bleed steam lines.

Utility's 'Best Laid Plans' Defeated by Dam Floods

Ohio Power Co's plans to erect a tower in the center of Hoover Dam Reservoir were discarded recently when water draining into the reservoir defeated several attempts at construction.

The utility, which is erecting towers across the northeastern area of Franklin County, planned one tower on the west bank and a second in the center of the reservoir. About $13,000 had been paid to nearby Columbus for permission to erect the center-reservoir tower.

First attempt to place pilings in the reservoir was blocked by thaw and rains which flooded the planned site. Then engineers began construction of a causeway to the spot, but rising waters washed away sections of the causeway.

As a result, Ohio Power has decided to obtain permission to erect the second tower on the east bank instead, and Columbus & Southern Ohio Electric Co is removing the dozen utility poles lined up across the flooded reservoir.

Rubber Cable Feeds

(*Continued from page* 95)

arresters are mounted on a galvanized steel double crossarm with all braces welded for strength and rigidity. Other hardware adjacent to current carrying parts were fabricated from anodized aluminum to cut weight and electrical losses.

Each single-conductor cable was installed in a separate 4-in. conduit for ease of handling and pulling. Use of non-metallic or aluminum duct eliminates hysteresis loss and one-point grounding cuts eddy currents to assure 460-amp current-carrying capacity in the cable at 40C ambient on exposed ends. Winter rating is much higher. Two 4/0 stranded bare copper wires in the concrete envelopes link shield wires, potheads and arresters on terminal poles with the substation grounding system.

Manholes are 6 x 10 ft to provide room for 42-in. splices and expansion and contraction of cable. Each splice required approximately 1½ days in the manholes and 1 day at the potheads. Minimum bending radius for the cable was held to 24 in. And the two-wide duct design provided easy racking of cables in the manholes as well as high heat dissipation in the duct runs.

Cable terminations in the substation also have aluminum riser conduits and single-conductor potheads. And valve-type lightning arresters have been provided as additional insurance of reliable supply to this vital substation.

Construction Budgets Set By Seven Electric Utilities

Recently announced construction budgets, many of them record-breakers, include the following:

- Southern Co will spend $93 million in 1956 for projects in its subsidiary systems; nearly half will go to Georgia Power Co.
- Los Angeles Dept of Water & Power will spend $335 million on five-year program. Largest item is $59-million Scattergood Plant near El Segundo.
- Almost one-third of Ohio Power Co's $67-million budget for this year will be spent on construction of Muskingum River Plant's No. 3 and 4 units.
- Northern States Power Co's budget for next three years totals $117 million.
- Construction, expansion of Columbus & Southern Ohio Electric Co will cost $26,243,300 in 1956.
- West Penn Power Co plans $25-million expansion this year; about half is slated for 165,000-kw Armstrong Plant.
- This year's program of Washington Water Power Co will cost $22.5 million. The 400,000-kw Noxon Rapids hydro project gets $15.7 million.

WALKER SELENIUM RECTIFIERS
INSTALL THEM — FORGET THEM
Engineered for Extra Years of
AC TO DC POWER CONVERSION

LOW COST, QUIET, HIGHLY EFFICIENT, LONG LIFE NO MAINTENANCE

Walker Selenium Rectifiers are engineered and built to give *extra* years of service and inexpensive operation. They are highly efficient, have a power factor of 97% and a DC ripple of approximately 4%. All Walker Rectifiers are low priced. Only the highest quality components are used. Any number of rectifiers may be paralleled. Write for full details, today.

THE Walker DIVISION NORMA-HOFFMANN BEARINGS CORPORATION

THE WALKER DIVISION
NORMA-HOFFMANN BEARINGS CORPORATION
Stamford, Connecticut

EMPLOYMENT OPPORTUNITIES

NATIONAL COVERAGE

RATES

DISPLAYED

The advertising rate is $19.15 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
An advertising inch is measured ⅞" vertically on a column—3 columns—30 inches to a page.
Subject to Agency Commission.

UNDISPLAYED

$1.50 per line, minimum 3 lines. To figure payment count 5 average words as a line. Box Numbers—counts as 1 line.
Position Wanted ads, ½ of above rate.
Discount of 10% if full payment is made in advance for 4 consecutive insertions.
Not subject to Agency Commission.

Send NEW ADS and inquiries to Classified Advertising Division of ELECTRICAL WORLD, 330 W. 42nd St., N. Y. 36, N. Y.

WANTED

MAINTENANCE ENGINEER

By a Midwestern Public Utility Company. Graduate Mechanical Engineer or equivalent, with a minimum of five years experience in High Pressure Power Plant Maintenance. A high caliber man is required in the planning, scheduling and advisory capacity relating to pulverized fuel fired, steam-electric plant maintenance.

Write stating education, experience, salary expected and availability to:

P-1271, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

ELECTRICAL ENGINEERS

SENIOR—
ASSISTANT and JUNIOR ENGINEERS
—COLLEGE GRADUATES

Electrical Design —
Public Utility Power Plants —
Distribution and Transmission Systems

ELECTRIC POWER STATION RELAY & APPLICATION ENGINEER—At least 5 years experience—preparation design and specifications of relay protection for power systems. Also for short circuit, power flow and stability studies. Knowledge of d-c and a-c network analyzer, operation and symmetrical components helpful.

ELECTRICAL ENGINEERS—SENIOR—At least 10 years design experience in steam or hydro plants and transmission substations. Knowledge of operation and construction desirable.

ELECTRICAL ENGINEERS—JUNIOR—Minimum 2 years experience—for electrical design of power stations and substations. Also for general analytical work on relay, short circuit calculations and economic studies.

Location New York—with long established service organization for large group of Utilities. Usual employe benefits. Reply stating age, education, experience, personal particulars and salary expected.

AMERICAN & FOREIGN POWER COMPANY INC and SUBSIDIARIES
2 Rector Street, New York 6, New York
21st Floor DI 4-4400 Ext 8494

ADVERTISING MAN WANTED FOR TECHNICAL PRODUCTS

Previous advertising experience not necessary but helpful. Must have at least two or three years of college with courses in engineering and technical subjects and like to write. If you have the qualifications we have an opportunity open for you. Man selected will be trained in all phases of industrial advertising. In your letter of application state age, education, positions held, and give statement of why you want a career in advertising. Location: well-known Connecticut company.

P-1205, Electrical World
330 W. 42 St., New York 36, N. Y.

POSITIONS VACANT

A well known Mid-Western Concern offers excellent opportunity for engineer capable of completely designing incandescent, mercury, and fluorescent street lighting luminaires. Your reply with complete qualifications will be held confidential. P-9436, Electrical World.

Superintendent—For electric and water utilities in city of 13,000 in heart of Fox River Valley. Electric Utility, New steam turbine generating plant 2—4000 KW—1—7500 KW—Distribution system 4160/2400Y. Water System, filteration and treatment plant for water taken from Fox River. Present superintendent is retiring. Reply stating age, education, experience, personal particulars, etc. All applications will be held confidential. Reply or stop at Menasha Electric and Water Utilities, 809 Broad street, Menasha, Wisconsin.

Transformer Engineer—Experienced in the design of dry type and liquid filled units through 5000 KVA. Chance to head department. Rapidly expanding company in pleasant N. J. suburb of metropolitan New York. Salary commensurate with ability. Send complete resume to P-1287, Electrical World.

EMPLOYMENT SERVICES

Salaried Personnel, $5,000-$30,000. This Confidential service established 1920, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited, Jira Thayer Jennings, P. O. Box 674, Manchester, Vermont.

POSITIONS WANTED

Power Engineer—Thirteen years experience in plants up to 100,000 K.W. capacity. Technical education, 29 years of age. Seeks responsible position. PW-9387, Electrical World.

Consulting Engrs., Chief Engr., Project Mgr. Reg EE-ME, 22 yrs. industry and railroads, 12 yrs consulting. Power plants, transmission, distribution, industrial. $15,000 N. America, $18,000 Central or So. America. 60 days availability. PW-1156, Electrical World.

Graduate Home Economist with utility background, successful experience with electrical manufacturer, Masters degree and experience in Social Work, able to work well with people—interested in a challenge. PW-1278, Electrical World.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)
LOS ANGELES: 1125 W. 6th St. (17)

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BOX NUMBER

When answering the classified advertisements in this magazine don't forget to put the box number on your envelope. It is our only means of identifying the advertisement you are answering.

CLASSIFIED SEARCHLIGHT SECTION ADVERTISING

BUSINESS OPPORTUNITIES — EQUIPMENT - USED or RESALE

UNDISPLAYED RATE:

$1.50 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

PROPOSALS, $1.50 a line an insertion.

BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE:

The advertising rate is $14.00 per inch for all advertising apearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

SEND NEW ADVERTISEMENTS TO: 330 West 42nd St., N. Y., for April 30th issue closing April 20th

---

FOR SALE

ROTATING STANDARDS

Types IB-6, I-B8 and I-B9
In excellent condition.

METERS

TYPE V6A 3 phase 4-wire Delta Meters, 15 and 50 amp. 240-volts — Condition, new and slightly used.

WANTED

METERS

Any quantity.

ATLANTIC
ELECTRIC METER CO.
214 East 41 St. N. Y. City 17

LARGE POWER EQUIPMENT

Prompt Stock Shipment
RENUBILT MOTORS - GENERATORS
TRANSFORMERS - CIRCUIT BREAKERS
DO YOU GET OUR STOCK LIST?
BELYEA COMPANY INC.
51 Howell St. Jersey City, N. J.

FOR SALE
Eight Condit Type "08" CIRCUIT BREAKERS

7500 Volt, 400 Amps., 50,000 KVA Rating on a CO-2 min-CO Duty Cycle. Manufactured 1936. In Good Operating Condition. If interested contact N. C. Stirewalt, V.P., Central Illinois Public Service Company, Springfield, Illinois.

"SEARCHLIGHT"

IS

Opportunity Advertising

—to help you get what you want.
—to help you sell what you no longer need.

Take Advantage Of It

For Every Business Want

"THINK SEARCHLIGHT FIRST"

WANTED

WATTHOUR METERS

Large Quantities

2 Wire 5 & 10 Amp bottom connected only.

Type OB, OC, CA, 1-16, 1-20, 1-30, JA.

Utilities Write or Call Collect

THE ELECTRICAL WATTHOUR METER CO.
76-15 Woodside Ave. Elmhurst 73, N. Y.
Phone HAvemeyer 9-0131

WANTED

2—500 KW
Frequency Changers
440 volts on the low side
25 cycle

Quote price, delivery, location and all other particulars.

W-1258, Electrical World
330 W. 42 St., New York 36, N. Y.

ELECTRICAL WIRE AND CABLE

—YOUR BEST SOURCE—

- for every industrial and power application
- Odd lengths—long and short—reasonably priced

One of the Largest Stocks in the Midwest

Let us quote on requirements—
send your inquiries
We'll also buy your Surplus

Branch Office:
Houston—Walnut 3-4580
FOR YOUR TEMPORARY NEEDS TRY OUR SURPLUS DIVISION

UNIVERSAL WIRE and CABLE Co.
2929 N. Paulina St. Chicago 13, Ill.
EAstgate 7-4777 Code: UNIWIRE

TRANSFORMERS

FOR SALE

3—1000 KVA Mol. 11500-2400/4160Y
3— 500 KVA W-H 33000-2300/2400
3— 500 KVA G-E 22000-2300/4000Y
3— 500 KVA GE 13200-2400/4160Y
2— 333 KVA W-H 38000-7200/12470Y
3— 333 KVA A-Ch 13800-240/480
3— 333 KVA G-E 7200/12470Y-2400/4160Y
6— 250 KVA G-E 13800-240/480
3— 250 KVA G-E 2415/2300-600
6— 200 KVA G-E 13200-2400/2300
6— 200 KVA G-E 13200-230/460

Many other items in stock

TRANSFORMERS WANTED

Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.
5316 Hetzel St.
Cincinnati 27, Ohio

40 Years' Dependable Service

MOTOR GENERATOR SETS

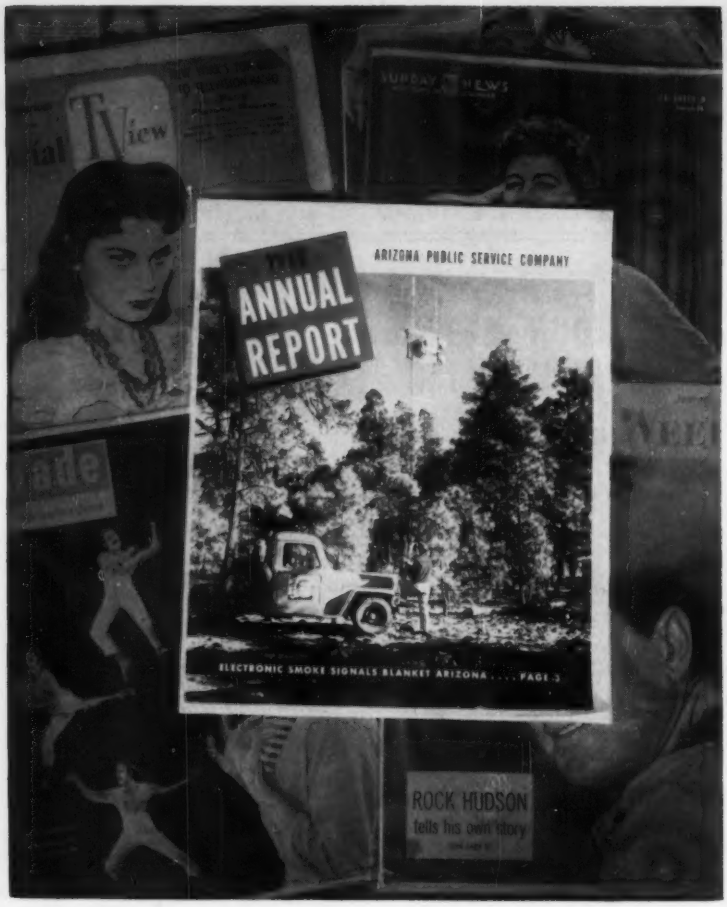
KW	MAKE	A.C.	D.C.
1250	Westg.	6600/4160	600
1000	G. E.	12,000	600
500	Westg.	2300	275
400	A. C.	2300	120/240
300	Westg.	2300/440	250
200	G. E.	2300	250/275
200	Westg.	2300/4000	250/275
200	Ridgeway	2300	250
170	G. E.	440	125
150	G. E.	2300	125/250
150	A. C.	2300	275
150	Westg.	2300	125/250
150	G. E.	440	275
100	G. E.	2300	250
100	Elec. Mch.	440	125
100	G. E.	440	125
90	G. E.	440	60
75	G. E.	440	125
50	Reliance	440	250

CHICAGO ELECTRIC CO.
1324 W. Cermak Rd. Chicago 8, Ill.

DIESEL ENGINES — POWER MACHINERY
DIESEL GENERATOR SETS—Stationary—Portable—Mobile
MOTORS and GENERATORS—100 KW to 1500 KW

A. G. SCHOONMAKER COMPANY, INC.
Main Office Box 516, Sausalito, Calif. Sausalito 1600
Branch 50 Church St., N. Y. 7, N. Y. Digby 9-4350

New and Used Equipment Available for
POWER PLANTS, SUBSTATIONS, TRANSMISSION LINES AND CONSTRUCTION
Send for new list to
EBASCO SERVICES INCORPORATED
APPARATUS EXCHANGE Two Rector St., New York 6, N. Y.


ARIZONA PUBLIC SERVICE COMPANY
ANNUAL REPORT
ELECTRONIC SMOKE SIGNALS BLANKET ARIZONA . . . . PAGE 3
ROCK HUDSON
tells his own story

Report Imitates Sunday Mag

Arizona Public Service Co, which last year achieved recognition for a novel approach in compiling its annual report, has again demonstrated its originality with the current report for 1955.

In a radical departure from traditional formats, the company has produced a report resembling a Sunday newspaper magazine section in appearance and size. Front and back covers are four color roto and so is the center spread. Color has been used in bar charts. Text material is lavishly illustrated with black and white pictures, with layouts following closely the Sunday magazine supplement type.

"Articles" on the company's operations and its territory are by-lined by appropriate officers whose portraits are also carried. Interest has been added with picture-text stories on such subjects as an average family's use of electric appliances, the growth of automation, the growth of Arizona, and the state's recreational facilities.

More traditional annual report data is handled as news stories. The report includes a statistical table for the financial analyst and a quiz test of 12 questions to find out how well the reader read the report.

The report is unique, attractive, and highly readable.

Public Information Manager Al Tudor notes that Pres Walter Lucking originally suggested doing this year's annual report as a supplement to the company's employee publication, Spark & Flame.

"We quickly saw the possibility of making it a little more elaborate without much additional cost by going to slick paper and using the rotogravure printing system," says Tudor.

"The newspaper supplement format offers the greatest possible flexibility in designing a publication. It allows the use of considerable white space, and provides ample opportunity for extensive use of pictures."

Readership reaction has been quick. The back cover of the report carries a coupon offering an Arizona vacation travel packet on request. The coupon, says Tudor, "is proving one of the most popular pieces of printed public relations that we have done. Although the report has been in the mail only a few days, we're already swamped with requests for the packet."

PUAA Schedules Varied Convention Program

The Public Utilities Advertising Association has completed arrangements for its 35th annual convention at the Hotel Warwick, Philadelphia, May 10-11.

Convention Chairman Robert H. Bridges of Cleveland Electric Illuminating Co, reports the speakers this year will include: Theodore Roosevelt III, president of Americans for Competitive Enterprise System, who will speak on free enterprise in America; Nicholas Samstag, promotion director of Time Magazine; Dan Packard, formerly with Nash-Kelvinator and now head of the marketing department at McCann-Erickson; Edwin Vennard, who will be managing director of EEI in June; Ernest Dichter, president of Institute for Motivational Research.

Also scheduled are: Robert R. Gros, vice president of Pacific Gas & Electric Co, who will talk on his recent 6,000 mi tour inside Russia; Frank Siedel, president of Storycraft, Inc, who will talk on "Business Films—a New Social Force"; C. S. Stackpole, managing director of American Gas Association; R. G. Rincliffe, president, Philadelphia Electric Co; E. H. Smoker, president, United Gas Improvement Co; and others.

The convention this year ties in with Philadelphia's celebration of Benjamin Franklin's 250th anniversary.

READERS FORUM

TVA Installed More Kw in Year

To the Editor:

The Ohio Valley Electric Corp. is to be congratulated on its achievement, reported on page 17 of your Feb. 13 issue, in placing in operation 11 generating units totaling 2,365,000 kw of capacity at its Clifty Creek and Kyger Creek plants within a 12-month period.

However, this is not, as your story reported, the first time this much generating capacity has been placed in operation on a single system in a 12-month period.

Without detracting in the least from the OVEC accomplishment, we believe it will be of interest to you to know that in the 12-month period ended Dec. 2, 1955, TVA placed in operation steam and hydro units totaling 2,655,000 kw of capacity.

Paul I. Evans
Director of Information

Tennessee Valley Authority
Knoxville, Tennessee

Reader Contributes Capacity Data

To the Editor:

Enclosed is a tabulation entitled, "Power Company Generating Capacities Compared with Total Generating Capacities in Geographic Areas in the United States, End of 1955 and with Additions Now Planned."

I believe that Electrical World readers would be very much interested in seeing this tabulation.

H. J. Benzing

Philadelphia Electric Co
Philadelphia, Pa.

• Reader Benzing's contribution may be found on page 66 of the April 9 issue.

Likes "Electrical World's" Leadership

To the Editor:

Your no-chimney issue of Nov. 2, 1953, which featured electric house heating, was a landmark for me. It strongly influenced me to keep trying in spite of almost too many bad jobs springing up all around.

Now, you have done it again. Your March 19 issue featuring the all-electric home contains some very fine and constructive information. I like the leadership and soundness of "Electrical World."

Electric utility attitudes are sometimes slow to change or to appear to be progressive. This is understandable when all their problems are carefully considered. However, there are already strong field indications that some electric utilities are moving on or into electric house heating much faster than some suppliers' field know-how and correct field procedures are prudently producing.

Clement L. Stanford

Electriliving Corp
4913 North College Ave
Indianapolis 5, Ind.

Oklahoma G&E Co Ranked Sixth

To the Editor:

I would like to call your attention to an oversight of our good company in the March 12 issue of your good magazine. Please refer to page 48 wherein were listed the ten top companies in percentage increase in net income for 1955 over 1954. If you will check the figures contained in the table above, you will note that our increase was 20%, which should have put us in 6th place. We are not bragging about this accomplishment but are humbly grateful. Being the publicity man, I would feel derelict in my duty if I did not call this to your attention.

H. P. Hoheisel
Advertising and Publicity Manager

Oklahoma Gas & Electric Co
Oklahoma City 1, Okla.

• And we would be derelict in our duty if we did not admit this oversight. Mr Hoheisel is correct. Oklahoma Gas & Electric Co rates 6th in percentage increase in net income.

Yes, There Is a Heat Storm

To the Editor:

When somebody you like very much and whose standards you hold in high esteem does something you do not like, it is irritating. I refer to the abuse of English in the title of your April 2 industry report—"The Heat Storm." "Storm" means a violent atmospheric disturbance.

Lovell B. Sawyer

13 Montreal St
Portland, Maine

• The term, "heat storm," was first used by a Kansas G&E supervisor. It is now so widely used throughout the industry that it may get into the 1960 revision of the Webster dictionary.

Specific Underground Rates Sought

Application for specific rates covering underground service by Southern California Edison Co represents a move toward clarifying the controversial area of overhead vs underground distribution facilities, with particular reference to cost responsibilities. The new schedules placed before the California Public Utilities Commission would add a surcharge to standard overhead rates for a new class of service wherein the company would furnish service from an underground distribution system installed at its own expense but not required for its operating convenience.

In its application, Edison stated this action follows requests for underground facilities from certain customers who do not fully appreciate the added cost of providing such facilities. The proposed rate schedule would apply to Edison's entire service area within designated underground distribution areas covered in the description of rates. The schedule provides for surcharges, covering both the service and energy, to be added to the charges (including minimum charge) described by the applicable overhead service schedules. Proposed adjustments to rate schedules applicable for service from overhead facilities are shown in the accompanying table.

The company stated it is ready, willing and able to provide such new type of service in the future to any group of customers which desires to pay the fair, just and reasonable rates required. Edison further added in the application that "any attempt by the utility to provide such service without charging fair, just, and reasonable rates required thereby to certain customers would, it is believed, result in the establishment of unreasonable differences as to rates, charges, service, and facilities, and would constitute an undesirable and prohibited preferential treatment."

Establishment of a rate commensurate with the cost of providing underground service, Edison contends, would enable the company to provide customers with such facilities. At the same time, these rates would fully advise uninformed persons of the additional charges necessary to meet their particular desires.

In setting the new underground rates, Edison used that portion of the rate base subject to change in the event underground facilities were substituted for overhead distribution plant. This portion was determined at about $151 million, about 23% of the total system rate base for the average year 1954. This amount then was allocated to customer groups whose rate schedules would be adjusted in the event of such substitution.

After determining the amount of such rate base for each of the customer groups, the amount was apportioned into cost components. An annual charge was determined by applying the estimated total annual fixed charges for ad valorem taxes, depreciation, income taxes, and return to the allocated capital costs. The annual charge for underground facilities was found to be six times the annual costs for equivalent overhead facilities, the system ratio used being 7 to 1.

Proposed Surcharges for Underground

Type of Service	Surcharge per Month		
	Per Cust	Per Kwhr	Per Hp or Kw
Domestic	$4.25	0.5¢	—
General	8.00	1.0¢	—
All other			
Connected load basis	8.00	0.5¢	$1.20
Demand basis (Kw of billing demand)	8.00	0.5¢	$1.20

TVA Director Defends 'Letters of Intent' Before Financing

A Tennessee Valley Authority director said recently that the agency's board would have been derelict in its duties if it had not issued letters of intent for proposed power expansion.

Dr Raymond R. Paty, who with Director Harry A. Curtis signed letters of intent, told the Tennessee Valley Public Power Association "the letters do not commit TVA to any particular method of financing the units."

"Letters of intent" are letters which TVA sends out to electrical manufacturers indicating it hopes sometime in the future to order certain equipment.

Comptroller General Joseph Campbell disclosed in Washington recently that on January 17 the TVA board authorized letters of intent for construction of seven generating units at a cost of $178 million.

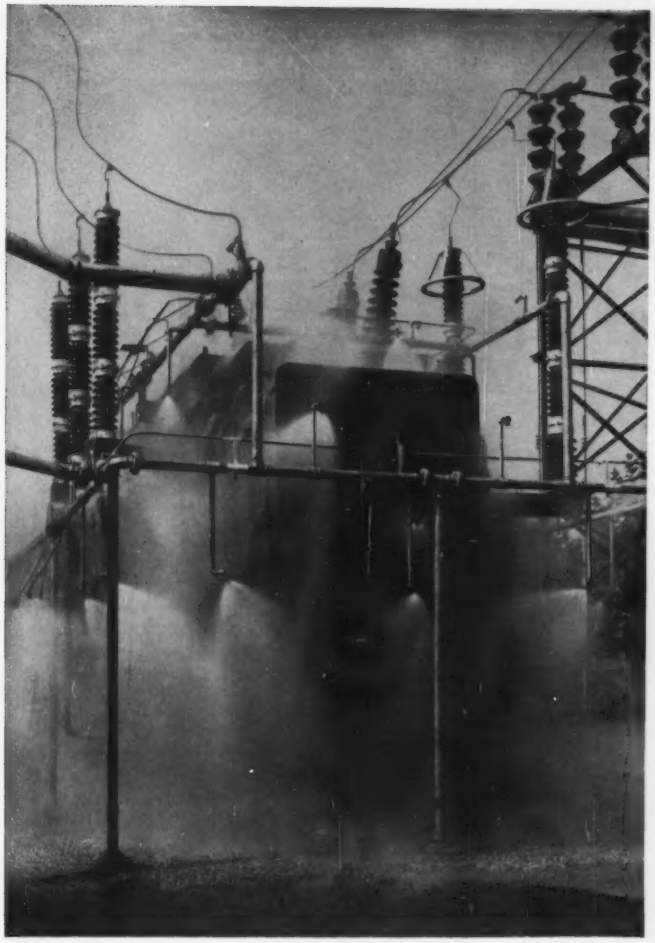
Paty and Curtis contend TVA has authority to use its power revenues to finance proposed expansion. Gen Herbert Vogel, TVA chairman and third member of the board disputes this.

Rep John Taber (R-N.Y.), called issuance of the letters "a calculated attempt to deceive" the House Appropriations Committee of which he is a member.

TVPPA's award for best annual report went to Tombigbee Electric Power Association, Tupelo, Miss. Second place went to the Chattanooga, Tenn., Power Board while the Mayfield, Ky., power system was in third place.

The managers' award, given to the district with the greatest number of managers who are members, went to Alabama. West Tennessee was second.

The association elected Ervin H. Wright, Brownsville, Tenn., president, succeeding Jesse F. Perry. W. L. Manton, Dalton, Ga., was re-elected secretary.



. . . give
your equipment
the best
fire protection

a BLAW-KNOX automatic FOG SYSTEM

Engineered to give your transformers and other equipment positive protection against fires, a BLAW-KNOX *Automatic* FOG SYSTEM goes into action immediately:

- **smothers flames**
- **dissipates heat**
- **protects adjacent equipment**
- **prevents loss of revenue**
- **prevents service stoppage**
- **avoids customer complaints**

Why not give your equipment the BEST possible protection? Let a Blaw-Knox *fire-protection* Engineer study your needs. He will gladly submit a layout and a cost estimate . . . with no obligation to you.

A BLAW-KNOX AUTOMATIC FIRE PROTECTION SYSTEM FOR EVERY NEED

"Little Joey Sprinkler" always on the job

BLAW-KNOX COMPANY

Automatic Sprinkler Department/Pittsburgh 33, Pennsylvania

BLAW-KNOX

Los Angeles W&P May Up Revenue Bond Limit

The Los Angeles, Calif., Water & Power Department plans to request a place on the November general election ballot for a proposed city charter amendment which would allow an increase in the amount of revenue bonds that can be issued by the department.

W&P, which now has authority to incur a bonded debt, without voter approval, of approximately 50% of capital investment, is asking that the ratio be raised to a limit of 57.1%.

The department stated it has reached the present limit, authorized in 1947, and the new limit is needed to provide an adequate financing program for new construction and improvements required by the increasing use of the present customers, and the large numbers of new users. Present plans call for an investment of $260 million over the next five years.

FINANCIAL BRIEFS

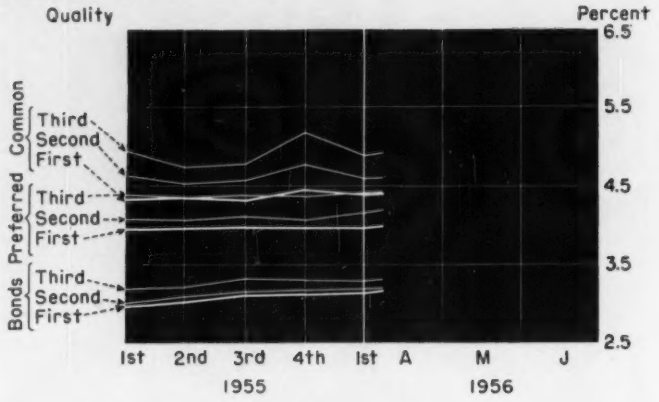
Village Council of Woodville, O., has voted against proposed sale of its municipal light plant and has voted 5-to-1 to repeal an ordinance which authorized sale of the plant. The Toledo Edison Co had been interested in its purchase.

El Paso Electric Co is planning to sell 20,000 shares of $100 par preferred stock at competitive bidding in May . . . **Central Illinois Electric & Gas Co** is planning to offer 40,000 shares of its common stock to eligible employees under the "Employee Stock Purchase Plan."

All but five shares of Louisville Gas & Electric Co's 20,000 shares of $100 par preferred stock were exchanged before the deadline on March 29. This was in accordance with the company's offer to convert each $100 par preferred share into four shares of $25 par preferred stock. These five shares have been called for redemption at $110 a share.

Final plans for marketing $135 million of Memphis, Tenn., power plant revenue bonds are expected to be ready in about 60 days, Mayor Edmund Orgill revealed recently. Salomon Bros & Hutzler, New York, will head syndicate managing bond sale.

Today's Utility Yields (%)



	BONDS			PREFERRED STOCKS			COMMON STOCKS		
QUALITY.....	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
April 5.....	3.18	3.21	3.32	4.01	4.22	4.45	4.42	4.61	4.94
Mar. 29.....	3.13	3.19	3.30	3.98	4.17	4.41	4.40	4.61	4.91

Utility Earnings

COMPANY	PERIOD MONTHS ENDED		NET INCOME 1955	NET INCOME 1954	EARNINGS PER COMMON SHARE 1955	EARNINGS PER COMMON SHARE 1954
American G&E, consolidated...	12	Dec.	$42,409,548	$36,301,938	$2.97(a)	$2.52(a)
Central Illinois Public Service..	12	Dec.	8,988,467	7,378,733	2.40	1.92
Central Vermont Public Service	12	Dec.	1,362,319	1,361,938	1.24	1.27
Cleveland Electric Illuminating	12	Dec.	17,810,321	14,063,891	2.49	1.93
Commonwealth Edison.....	12	Dec.	46,460,734	44,871,388	2.62	2.70
Consolidated Edison of N. Y....	12	Dec.	52,320,256	50,289,300	3.12	2.98
Detroit Edison.....	12	Dec.	26,297,189	22,137,173	2.43	2.05
Pacific Gas & Electric.....	12	Dec.	71,034,814	63,039,149	3.32(a)	2.89(a)
Texas Utilities, consolidated...	12	Dec.	24,315,216	22,760,323	2.06	1.93

Notes—All the figures shown above have been audited; (a) Based on average shares.

Utility Financing

COMPANY AND DESCRIPTION	AMOUNT OF OFFERING (000)	OFFERING PRICE	YIELD TO PUBLIC
APRIL 5-11			
BONDS			
Kentucky Utilities—1st mtg 3¼% due 1986.....	$10,000	101.447%	3.67%
PREFERRED STOCK			
Kansas City Power & Light—120,000 sh 4.35% $100 par	$12,000	$100	4.35%
COMMON STOCK			
El Paso Electric—56,025 sh (being offered commonholders on 1-for-15 basis, record April 4 to expire April 25).....	$2,073	$37.00	4.86%
SCHEDULE FOR APRIL			
BONDS			BID DATE
Southern California Edison—1st mtg due 1981.....	$40,000	.....	April 17
Wisconsin Electric Power—1st mtg due 1986.....	30,000	.....	April 24
PREFERRED STOCK			
Long Island Lighting—120,000 sh.....	$12,000	.....	April 26(a)
COMMON STOCK			
New England Electric System—834,976 sh (to be offered commonholders on 1-for-12 basis).....	.....	.....	.....

Note—(a) Blyth & Co—First Boston Corp and W. C. Langley & Co.

DOW

GIVE HIM THE RIGHT TOOLS FOR THIS JOB!

DOW WEED AND BRUSH KILLERS provide an effective, money-saving vegetation control program.

Ask the men who man the axes. Brush and weed control is tough and tedious. And manpower is worth money today! Check the figures—cutting is a time-consuming, reoccurring and costly expense.

Better Control With Chemicals

Sure, you've got to keep right-of-ways clear—to minimize service interruptions, outages, reduce fire hazards and to guard the safety of repair crews. But give the crew the right tools to work with—Dow weed and brush killers.

Investigate Dow programming—the proper use of the right chemical specifically designed to control problem species in your area. Dow herbicides give better kill, control regrowth longer—at lower costs.

Special Chemicals for Brush, Grass

Try Esteron® 245, Kuron® or Esteron Brush Killer on trees or brush. Available for use with either petroleum or water carriers. They combine hard-hitting power with low drift, low toxicity qualities. Try Radapon*, containing dalapon sodium salt, the amazing systemic grass killer.

BARON—Complete Weed Control

Use Baron*, a semisterilant for control of broad and narrow-leaved weeds. It is ideal for use around substations, storage areas and plant sites.

Application techniques are simple—your own crew can do the job—or we'll be happy to recommend a custom applicator near you. We'll be glad to send cost figures showing how other people saved money by using Dow selective herbicides. Write THE DOW CHEMICAL COMPANY, Industrial Section, Agricultural Chemical Sales Department, Midland, Michigan.

*Trademark of The Dow Chemical Company

you can depend on DOW AGRICULTURAL CHEMICALS

DOW

PROFESSIONAL SERVICES

BARKER & WHEELER

Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

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BLACK & VEATCH

Consulting Engineers

Electricity—Water—Sewage—Industry

Reports, Design, Supervision of Construction
Investigations, Valuations and Rates

4706 Broadway — Kansas City 2, Missouri

THEODORE D. BROSS LINE CONSTRUCTION CORP.

Steel Tower & Wood
Transmission Lines
Distribution & Maintenance

175 Enfield St. — Hartford, Conn.

DAY & ZIMMERMANN, INC.

Engineers

Design - Construction - Management
Reports and Valuations

New York — Philadelphia — Chicago

Doble Engineering Company

Electrical Insulation Engineers

Field Testing and Maintenance of High Tension Insulation, Special Problems in Electrical Communications

Office and Laboratory: Doble Park
Box 344, Belmont 78, Mass. (6 miles from Boston)
Branch Office: 20 N. Wacker Dr., Chicago, Ill.

ELECTRICAL TESTING LABORATORIES, INC.

Electrical, mechanical, photometric, radiometric and chemical laboratories, rendering testing, research and associated services, including certification, inspections at factories and field investigations.

2 East End Avenue at 79th St., New York 21, N. Y.

ROBERT E. FOLEY CONSTRUCTION CORPORATION

Construction & Maintenance

Transmission—Distribution—Communication Lines
Substation, Radio and Television Towers

48 Griswold St. — Binghamton, N. Y.

FORD, BACON & DAVIS

Engineers

DESIGN • CONSTRUCTION
VALUATIONS • REPORTS

New York • Chicago • Los Angeles

GILBERT ASSOCIATES, Inc.

Engineers • Consultants • Constructors
Reading, Pa.

Engineering and Design • Construction Supervision
Industrial • Sanitary • Safety
Chemical Laboratory Services
Business and Economic Research
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New York — Philadelphia — Washington
Rome — Manila — Medellin

HARZA ENGINEERING CO.

Consulting Engineers

Calvin V. Davis — E. Montford Fuzik
Richard D. Harza

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Transmission Lines
Flood Control, Irrigation
River Basin Development

409 West Madison Street — Chicago 6

HOOSIER ENGINEERING COMPANY

Erecting Engineers

Transmission Lines, Substations

1384 Holly Avenue, Columbus, Ohio

JACKSON & MORELAND, INC.

Engineers and Consultants

Design and Supervision of Construction
Reports—Examinations—Appraisals
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Piping System Design Analyses

Unique model tester as well as modern digital computer facilities available for low cost, accurate flexibility analyses of the most complex piping systems.

The M. W. Kellogg Company,
225 Broadway, New York 7, N. Y.

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Engineers - Constructors - Consultants

POWER PLANT SPECIALISTS
(Steam, Hydro, Diesel)

Utility • Industrial • Chemical

1200 N. Broad St., — Philadelphia 21, Pa.

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Design and Consulting Engineers

Electrical • Mechanical • Structural
Civil • Thermodynamic • Architectural

First National Bank Building
Pittsburgh 22, Pennsylvania

N. A. LOUGEE & COMPANY

Engineers and Consultants

REPORTS — APPRAISALS
DEPRECIATION STUDIES—RATE CASES
BUSINESS AND ECONOMIC STUDIES

120 Broadway — New York

LUCAS & LUICK

Engineers

DESIGN, CONSTRUCTION, SUPERVISION,
OPERATION, MANAGEMENT, APPRAISALS,
INVESTIGATIONS, REPORTS, RATES

231 S. LaSalle St., Chicago

THE LUMMUS COMPANY

Engineers and Constructors

385 Madison Ave., New York, N. Y.

Chicago . . Houston . . London
Paris . . The Hague . . Montreal
Caracas . . Bombay

CHAS. T. MAIN, INC.

Engineers

Electric, Steam and Hydraulic Projects,
Investigations, Reports, Designs and Appraisals

Chamber of Commerce Building
80 Federal St., Boston 10, Mass.

PIONEER SERVICE & ENGINEERING CO.

Consulting and Design
Engineers..Purchasing
Specialists in Financing
Accounting and Other Operations

231 So. La Salle St. — Chicago 4

REIS & CHANDLER, INC.

ADVISORS TO UTILITIES

Financing—Rate of Return

80 Vesey Street, — New York 7, N. Y.

SANDERSON & PORTER ENGINEERS

Design
Construction

New York — New York

SARGENT & LUNDY

ENGINEERS

140 South Dearborn St.

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Hydraulic Engineering, Hydro-electric Development, Water Supply, Flood Control, Engineering Problems relating to Water Rights and Water Power Law. Appraisals

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Construction and Maintenance

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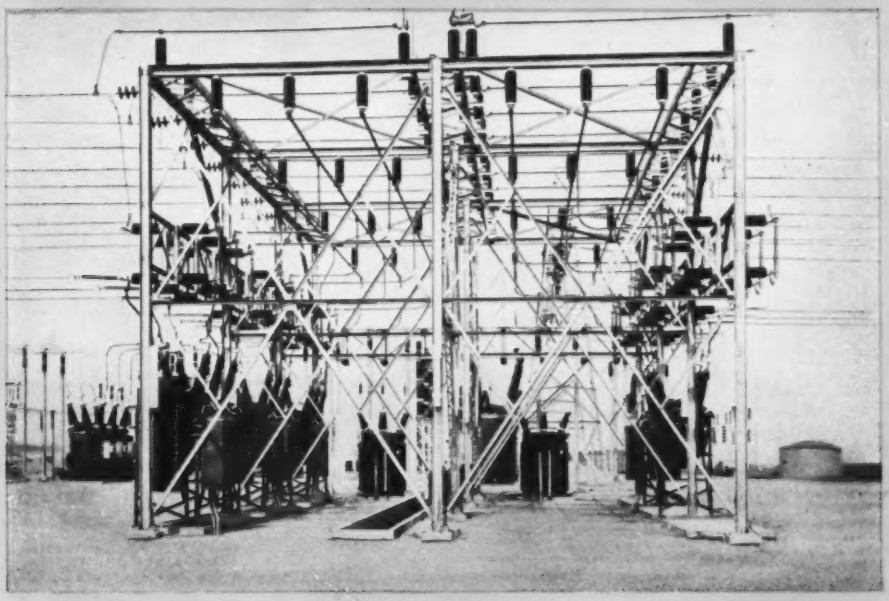

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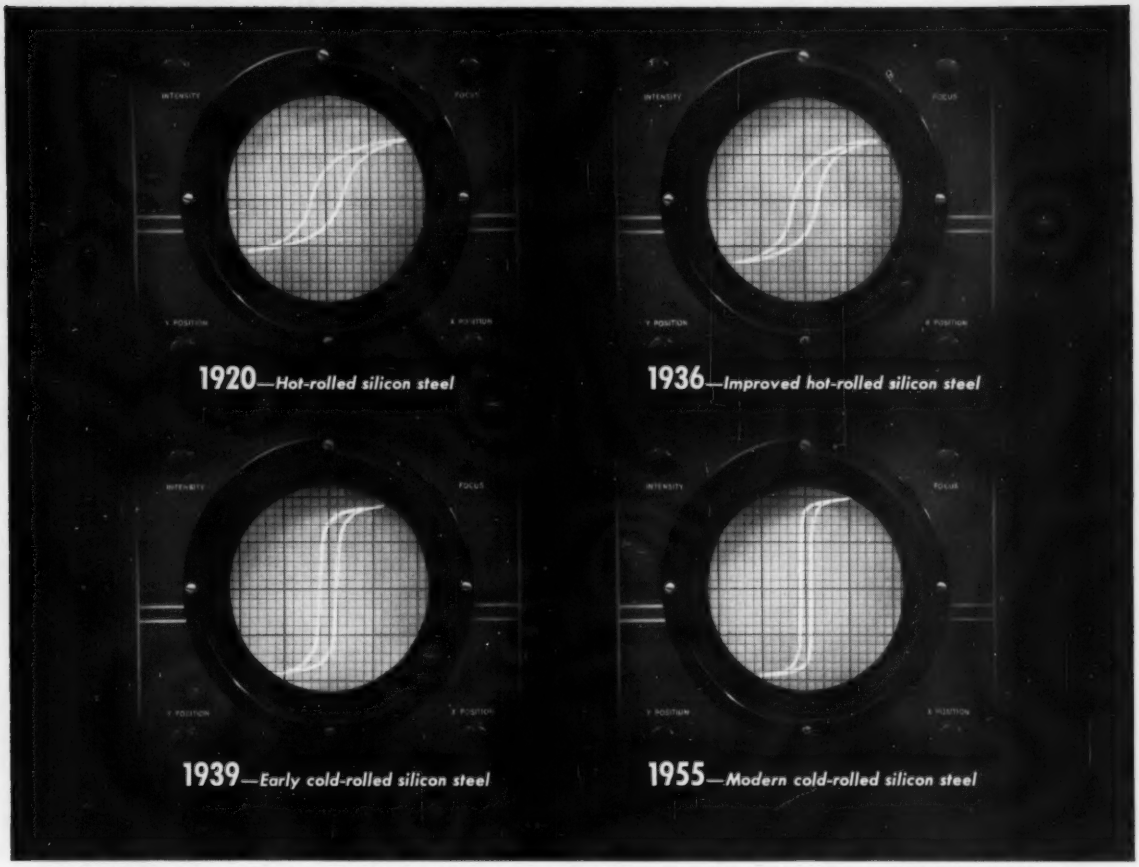

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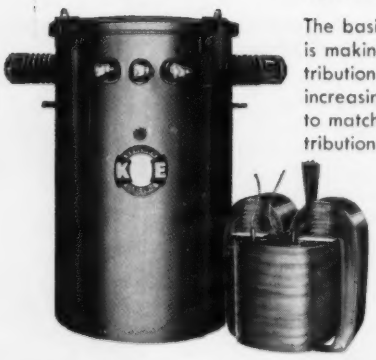

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